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LIGHT AND X-RAY TREATMENT OF SKIN DISEASES

Alexander
(Sir)

BY

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INTRODUCTION

This little book is not intended to be an exhaustive monograph on the subject of which it treats, but a concise summary of the methods of application and results of Finsen's light treatment, X-rays, and other therapeutic agencies which have been introduced into dermatological practice within the last ten or twelve years. The conclusions are based mainly on our own experience, but the work of others in the same field has received due attention. Our aim has been not to give records of "cures," but to set forth in their true light the facts we have observed, and to help the reader to form an accurate estimate of the value of the several methods described.

The most prominent place is occupied by a discussion of the advantages and disadvantages of the light treatment originated by Niels Finsen, and by an exposition of the views as to its application and its usefulness to which we have been led by an experience extending over more than seven years. There has undoubtedly been a good deal of exaggeration in many quarters as to the curative effects of the light treatment. This is almost inevitably the case with a new discovery which seems to offer the promise of a cure for a disease previously refractory to treatment, such as lupus.

The hope that springs eternal in the human breast is apt to soar aloft on wings fanned by enthusiasm into the ethereal region that lies beyond the atmosphere of solid fact. In this way much harm is done, not only by disappointment on the part of sufferers, but by a reaction of scepticism in the minds of practitioners. Having been among the earliest pioneers of the light treatment in London, we may also claim to be among those who have used it most largely in this country. Our opinion on the subject has, therefore, at least the value that attaches to any judgment founded on practical knowledge. If we are unable to speak in the optimistic tone of some other authors, that fact may perhaps be held to give more weight to what we have to say in praise of the treatment.

In a paper, published in the *British Medical Journal* of May 31st, 1902, we said: "Although in our opinion the results we have obtained have fully justified the employment of the treatment, and in some cases no other treatment could have produced such good results, we do not regard it as the only method to be used in all cases, nor advocate it indiscriminately to the exclusion of other methods."

In the issue of the same journal of October 28th, 1905, we said that the outcome of the further experience there recorded might be given in the self-same words. The author went on to say: "Speaking as one who during more than twenty-five years has tried all methods having the sanction of professional authority or appearing to rest on a scientific basis, I can say that the light treatment has, in my hands, produced results on the whole superior to those which I have

obtained by any other. Not a few cases are, however, met with in practice in which it cannot be applied, and even when it *can* be applied it often fails to effect a thorough cure. Even when the disease is to all appearance healed, the cure is not often lasting. I think it right to state the conclusions to which our experience had led Dr. Dore and myself, all the more plainly because the natural tendency to exaggerate the curative virtues of a new remedy has in some quarters led to the expression of what seems to me an unduly optimistic opinion of the efficacy of Finsen's method."

This was the expression of an opinion which increasing experience has tended to confirm. The difficulty of treating lupus lies in the fact that the disease is so variable in extent, severity, course, and constitutional effects that no method can be universally applicable. There are cases which can be successfully dealt with by almost any form of local treatment; on the other hand, there are cases which no means at present known to medical science can cure. In illustration of this point, reference was made to the case of a patient with a small non-ulcerating patch of lupus on the cheek. Light, X-rays, and radium all failed to do more than cause a temporary disappearance of the nodules. Almost every known method of treatment had previously been tried in vain. The fact must be faced that, in spite of all the therapeutic progress that has been achieved, cases are still met with which resist the action of the newer physical, as well as the older, methods. It is not the mere extent of the disease that makes it more refractory, for the

quality is equally displayed in small patches. Possibly the way to success may lie in the discovery of some means of modifying the soil.

Lupus vulgaris sometimes presents the characters of a general infection, the pathogenic organisms being distributed by the blood stream and multiple foci becoming developed in different parts of the cutaneous surface and on mucous membranes. In such cases the light treatment is as powerless as any other to check the progress of the disease. Where the disease is limited to a small patch, and does not penetrate deeply into the tissues, Finsen's method is decidedly superior to any other, for the lupous tissue can be destroyed without pain or subsequent scarring. It is also effective sometimes even when the disease is extensive; in such cases its advantages as compared with scarification, caustics, and the knife are especially conspicuous, for it does not produce the hideous disfigurement left by those methods. It may be added that the light treatment does not leave its mark in the form of the local hypervascularity which frequently follows the application of the X-rays. If the disease recurs, the light treatment may be continued for an indefinite time without injury to the original scar.

When the disease is rapidly spreading, the destructive action of the light, to which only a very small area can be exposed at a sitting, is altogether insufficient to keep pace with its advance. In such circumstances Finsen's method requires to be supplemented by the X-rays, which can be applied to the whole or a large part of the affected surface. Indeed, in all cases under our care, except those in which the

disease has been quite superficial and of small extent, the two methods have been used in combination.

Each of these agents has its special field of usefulness. When there are only one or two superficial scattered patches or a few isolated nodules, the light may generally be trusted to do all that is needed. When the disease is of moderate extent, the whole area may be treated by the X-rays, while light is applied to the edges of the satellite nodules. Where the lupus is very extensive, it may be controlled by the exposure of considerable areas to the X-rays, this being followed up subsequently by the employment of light.

It is in cases in which the face is the seat of non-ulcerated lupus of limited extent, and especially when no previous treatment has been employed, that light is most effective. When the greater part of one or both cheeks is invaded, the X-rays should be used. Much time may, as we have had occasion to observe, be lost by attempting to treat extensive patches by Finsen's method alone.

The X-rays are especially useful in cases in which mucous membranes that are inaccessible to the light are affected. They are of particular value when recurrence takes place after temporary cure by the light treatment. Besides their greater destructive power, the X-rays have the further advantage in such cases that shorter applications are required and large areas can be treated, while the patient is spared the pain and inconvenience of the repeated inflammatory reactions, with the attendant soreness and scabbing, produced by the light treatment.

In ulcerating lupus the X-rays are often very serviceable, while the light is usually ineffective. In many cases, whether the light or the X-rays, or both, are used, the treatment has to be reinforced by the employment of caustics. Applications of pyrogallic acid, salicylic acid, singly or in combination, acid nitrate of mercury, nitrate of silver, and pure carbolic acid may be needed to prepare the way for the light or X-rays by removing the horny layer and getting rid of the thickened and pigmented tissue. In all cases, small or extensive, in which the disease proves refractory to the light, carbolic acid or tincture of iodine may also be employed to increase the reaction caused by the light or the X-rays.

Full details of our experience of these methods, not only in lupus but in other diseases, are given in the present volume. To sum up our conclusions in a few sentences, we believe that Finsen has made a most valuable addition to our therapeutic resources in dealing with certain diseases of the skin, but that, like every other remedy, his method is neither infallible nor free from serious drawbacks. The same thing may be said of the X-rays, and still more emphatically of other methods, such as high-frequency currents, radium, etc. But, used in combination, with special adaptation to special conditions, they give results which a few years ago would have been altogether beyond the reach of medical art.

NOTE.—As accuracy in these physical methods is of great importance for their success, we take this opportunity of expressing our thanks to our nurses, Miss Olsen, Miss Bytham, and Miss M. Bytham, and to our electrician, Mr. Hoare, for the conscientious manner in which they have carried out the details of the various forms of treatment.

LIGHT AND X-RAY TREATMENT OF SKIN DISEASES

CHAPTER I

LIGHT TREATMENT: PRINCIPLES, TECHNIQUE, AND THERAPEUTIC EFFECTS

Definition—Principles—Microscopical changes in tissues caused by light—Pathological changes in the skin produced by the actinic rays—Bactericidal properties of light—The Finsen lamp—The Finsen-Reyn lamp—Other lamps—Preparation of the patient—Fixing of the compressor—Time of exposure—The reaction—Constitutional effects—Effects on the eyes and on the nasal mucous membrane—Advantages—Disadvantages—Unfavourable conditions—Reinforcement of the treatment—Therapeutic results—London Hospital statistics.

Definition.—On account of the loose way in which the terms "light" and "Finsen" treatment are used by many writers, it is necessary to state at the outset what these expressions imply. In the first place, the X-rays should not be included under the term "light treatment." They have nothing to do with light in the ordinary sense of the word. They are not on the visible spectrum and have not the physical properties of light, such as refraction, polarisation, and reflection. For purposes of description, therefore, their employment for therapeutic purposes should not be designated light treatment, but X-ray treatment. The term "light treatment" should be reserved for the use of the rays of ordinary spectroscopic light and the ultra-violet rays;

indeed, for all practical purposes it may be restricted to the chemical or actinic rays, viz., the blue, visible violet, and ultra-violet rays, or, in other words, the therapeutically active rays. The small proportion of yellow and green which may take part in the effect may be neglected. With the red and infra-red, or heat-rays we are not concerned except in regard to excluding them from acting upon the skin. The employment of incandescent lamps, often of different colours, in baths, is, as pointed out by Finsen, of little value as regards the chemical activity of the light, and is simply a convenient means of applying heat in order to produce diaphoresis.*

Principles of the Finsen light treatment. – The physical principles on which Finsen's method of treating lupus and other diseases of the skin by means of the chemical rays of light is based, are summed up in the following propositions:—

1. Light acts as a stimulant of organic life. This fact has been demonstrated by Finsen himself and others by experiments on the movements of certain animals, and the stimulating property has been shown to reside chiefly in the actinic or chemical rays of light.

2. The chemical rays have the property of causing an inflammation of the skin. Bowles and other authors have shown that "erythema solare" is due to the action of the actinic rays, and Finsen's observations confirmed this statement. Charcot, Widmark, and others proved

* Finsen, "Neue Untersuchungen über die Einwirkung des Lichtes auf die Haut." (*Mittheilungen aus Finsen's medicinischen Lysinstitut, Copenhagen*, 1899.)

the same thing in regard to the dermatitis produced by electric arc light ("erythema electricum").

3. Light has bactericidal properties. This, as we shall see, was proved experimentally by Downes and Blunt, Duclaux, d'Arsonval and Charrin, and others, and finally by Finsen, who showed that the bactericidal action increased in direct proportion to the degree of concentration of the rays.

4. Light can penetrate the skin. This is shown in "transillumination," and has been proved by Godneff by experiments on animals, and by Finsen for concentrated light.

5. Other facts bearing on the point are the effect of light on plants, the protective value of pigmentation in animals, and the exclusion of the chemical rays in the treatment of variola, revived and explained by Finsen in 1893.

Microscopical changes in tissues caused by light.—Besides investigating the macroscopic effects of light on the skin, Finsen demonstrated the minute histological changes which occur in the tissues of the tadpole when they are exposed to the sun's rays. The body of a tadpole was enveloped in filter-paper soaked in water, and placed on the stage of the microscope. It was then exposed to the rays of the sun. After from ten to fifteen minutes changes occurred. The capillaries became dilated, the blood stream slowed, and diapedesis took place, as in simple inflammation. Finsen also observed that the red corpuscles contracted.

Other observations have been made by Auerbach, who found that light caused contraction of the protoplasm of the eye of the frog, and by Engelmann, who

observed contraction of an amœba when exposed to light, followed by rapid expansion in sudden darkness. The same author also pointed out that the rods and cones of the retina shorten in light and lengthen in darkness.

Pathological changes in the skin produced by the actinic rays.—Investigations have been made by MacLeod and by Glebowsky on tissues previously exposed to the rays from the Finsen lamp. The former, who used the London Hospital modification of the Lortet-Genoud lamp, found that the prickle cells of the epidermis were swollen from parenchymatous œdema. Here and there the lymphatic spaces were dilated so as to form small vesicles. The superficial blood-vessels were dilated and surrounded by small mononuclear cells like those found in simple inflammation. The conclusions MacLeod came to are as follows:—

1. That the action of the actinic rays from an arc lamp on the granuloma of lupus is essentially destructive, and that this destructive process is indirectly produced, and is simply the result of an ordinary inflammatory reaction.

2. That the effect of the rays on the surrounding healthy tissues is negligible, so that the doubtful tissue in the neighbourhood of a patch of lupus may be safely exposed to them without subsequent injury and scarring.

3. That the destructive process, if the rays are judiciously employed, is not of such intensity as to prevent subsequent repair, and that a few days after it has reached its acme a process of reconstruction sets in similar to that which takes place in the healing of inflammation.

4. That the process of construction is capable of

replacing the destroyed granuloma with healthy fibrous tissue, forming a pliable scar, and that the epidermis completely recovers from the œdema caused by the action of the rays. Hence from the histological standpoint the treatment of lupus and other granulomatous affections of the skin by the actinic rays is an ideal one.

Bactericidal properties of light.—Although ordinary light is perhaps credited with greater bactericidal power than it deserves, there is no doubt that it has the property of inhibiting the growth of micro-organisms, and even of destroying them. This property, again, is due in great part to the chemical rays, and particularly to the ultra-violet. The first workers in this subject, Downes and Blunt, published their results in 1878. They exposed cultures to different coloured lights, and came to the conclusion that the chemical rays were the most actively bactericidal. D'Arsonval and Charrin experimented with *Bacillus pyocyaneus*, and showed that the chemical rays are the only ones which have a destructive influence upon this organism. Finsen found that direct sunlight killed *B. prodigiosus* in plate cultures within one hour, while an electric arc lamp of 25 ampères took eight to nine hours to kill a plate culture of the same bacillus at a distance of 75 cm. He then tried the effect of concentrated light upon *B. prodigiosus* and the typhoid bacillus. The result was that by concentrated sunlight the organisms were killed fifteen times more rapidly than by direct light, and that the effects of concentrated arc-light were still more powerful. In other words, the germicidal action increased in proportion as the rays were concentrated.

It has also been demonstrated by Bie and others

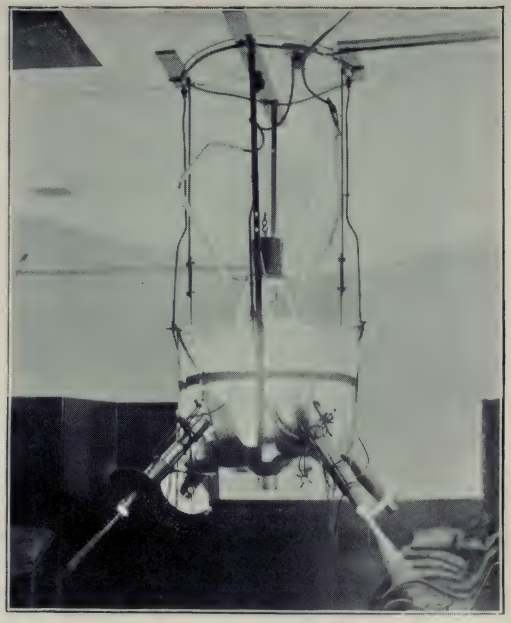
that the bactericidal power of light resides chiefly in the ultra-violet rays.

Notes on apparatus.—As a full description of the many varieties of apparatus used for the production of light does not lie within the scope of this work, we propose to do little more than give a brief account of the apparatus with which we have obtained the results recounted—the Finsen and the Finsen-Reyn lamps.

The Finsen lamp.—The original Finsen lamp (Plate I.) consists of a suspended arc lamp of a capacity of 60 to 80 ampères, around which are arranged four tubes or collectors, which serve to collect and concentrate the light by means of a system of quartz lenses, the rays converging in a conical beam from the lowermost lens of each collector. The tube is fitted with a sliding telescopic adjustment, by means of which the focus of the rays may be brought nearer to the patient, and another adjustment allows of a vertical movement. The lower chamber of the collector is filled with distilled water, through which the light rays pass. The water serves to absorb the heat rays, and is further cooled by a surrounding jacket containing circulating water.

In order yet further to cool the concentrated rays, and to allow them to penetrate the tissues, a quartz compressor through which water circulates is fixed or held upon the skin within the focus of the converging rays. The lower surface of the compressor is made in varying degrees of convexity or concavity according to the contour of the skin surface pressed upon. Between the quartz faces two nozzles are fixed for the reception of rubber tubes conveying circulating water.

Owing to the liability of the top lenses of the



THE ORIGINAL FINSEN LAMP.

THE FINSEN-REYN LAMP (MODIFIED).

PLATE I.

collectors to crack, these, in the most recent pattern, are surrounded by a separate water jacket. The lenses, especially the lower one and the compressors, must be kept clean and bright, and the distilled water should be changed frequently.

The Finsen-Reyn lamp.—In principle this is similar to the Finsen lamp, but a single collecting tube, fitted on an adjustable stand, is placed in front of a scissors arc lamp consuming about 20 ampères. The lamp has the advantage of being much less cumbersome and less costly than the other, and one patient is treated instead of four. Less light is wasted, because the crater of the arc is in the centre of the top lens instead of above it, and in our opinion it is even more efficient, most patients requiring only an application of forty-five minutes, instead of an hour with the older lamp. One disadvantage is that in certain positions, particularly under the chin, it cannot be used, on account of the projecting end of the stand supporting the collector. We have obviated this disadvantage by having the base of the stand shortened and the U-piece moved further back, as shown in the photograph (Plate I.). The light is passed through distilled water, which is water-jacketed, and quartz compressors containing circulating water are used in the same manner as in the large lamp.

Two or three devices have recently been introduced for mechanically fixing the compressors on the part treated, but we regard the constant supervision and sense of touch of a trained nurse as essential factors in the success of the method.

Other lamps.—In the French lamp of Lortet and Genoud, the divergent rays of the electric arc are not

first made parallel and then convergent by a system of lenses, as in the Finsen apparatus, but the patient is brought close to the source of light just as they begin to diverge. There is, therefore, no focussing in this lamp, and consequently the intensity and penetration of the light are not so great. Only one layer of water is interposed between the patient's skin and the source of light, so that the heat rays are not so well eliminated, and the effect is therefore more caustic and more of the nature of a burn, as well as more superficial, than that of the Finsen lamp. The various modifications of the Lortet-Genoud lamp, *e.g.* that of Marshall and Woods, differ only in mechanical details, the principle of construction being the same. The area of skin treated with this lamp is much larger (four times) than that dealt with by the Finsen lamp, and the exposure is only 10 minutes or 15 minutes instead of the hour with the larger apparatus. The ampèrage is 10-15 instead of 60-80 (the new small Finsen lamp requires 15-20 ampères). The pressure is exerted by the patient himself, assisted, perhaps, by a nurse: there is no compressing-glass to be held or strapped on, as in Finsen's method.

In our opinion the original Finsen lamp and the Finsen-Reyn lamp are the best, on account of the greater intensity and penetrating power of the concentrated light, and are the only lamps which give the results claimed for them by their inventor.

Some lamps consist of devices for applying a large proportions of violet, and especially ultra-violet, rays to the skin, by means of water-cooled iron electrodes. Such is Bang's lamp, of which the "Dermo" is a modifica-

tion. In the Miller lamp iron electrodes are also used, and ice is employed to exert pressure on the skin. The exposure of these lamps is very short, and a severe superficial erythema is caused in a short time. The ultra-violet rays, however, are not concentrated, and the effect of these rays is too superficial to be of use in a deep-seated disease like lupus.

Other means of applying light, such as reflected arc-light passed through blue glass and thrown upon the body of the patient like a search-light, need not be described here. Finsen's sun-treatment of lupus by means of large lenses containing a blue solution of copper-sulphate is impracticable in this country, and has, we believe, been abandoned in Copenhagen on account of its obvious drawbacks and the greater efficiency of the electric light.

Preparation of the patient.—First the crusts are removed with forceps; the area to be treated is then bathed with boric lotion, and, if there is any grease on the part, with ether. Of late years we have used solutions of either lysol or lysoform, which sufficiently remove grease. The skin is then marked with a blue pencil so as to ensure the light being applied to the same spot.

Fixing of the compressor.—Having undergone this preparation, the patient lies on a couch in such a position that the focussed rays are directed on to the area to be exposed (by means of a circle of holes in the cap of the lens the focus may be approximately obtained before the cap is removed). A suitable compressor, consisting of a crystal chamber containing circulating water, is then pressed upon the skin by the nurse and held in

position, with its upper face at right angles to the impinging rays, during the whole of the application.

Time of exposure.—With the large Finsen lamp an exposure of one hour was the rule, but with the Finsen-Reyn lamp, in which the crater of the arc is in the centre of the top lens of the collecting tube and nearer the lens, there is less waste of light, and, the focussed rays being stronger, we have found an application lasting three-quarters of an hour sufficient, in the large majority of cases, to produce a good reaction.

After the treatment the compressors are cleaned with spirit and carbolic acid. The diseased surface which has been treated is dressed, if necessary, with a simple zinc lanolin ointment, or with a paste of zinc, vaseline, and starch, and a little boric acid.

The reaction.—The resulting reaction varies according to the idiosyncrasy of the patient and the time of exposure, but also depends upon the intensity of the light at the time of exposure, which itself depends upon many factors, such as the size and greater or less exactitude of the focus, the clearness of the water and lenses, the quality of the carbons, &c. In addition to these factors there are those, of course, which arise in the nature of the part that is being treated, namely, the depth of the disease, the amount of scarring, pigmentation, and vascularity.

Onset.—This varies from five or six hours to twenty-four hours; it is generally noticed the following morning.

Severity.—The reaction is usually slight for the first few days of treatment, and then becomes more marked; it does, however, appear in some cases to diminish in intensity after continual treatment.

Pain.—It is not true that the Finsen treatment is painless. An ordinary single application is practically free from pain, but pressure over a bony prominence is sometimes painful, and when the pressure cannot be evenly exerted, as in such situations as the inner canthi, the burning effect of the light is sometimes felt. The same result may be due to the escape of light from the edge of a small convex compressor.

When a small area is treated, and the applications are repeated frequently upon the same spot, the resulting inflammatory reactions are more painful. Usually, however, six or seven consecutive daily exposures may be applied to the same area without causing more than a trifling inconvenience.

Variability.—The reaction varies but slightly according to the idiosyncrasy of the patient, and the conditions which hinder its appearance have already been enumerated. Other things being equal, its intensity and time of onset are fairly uniform.

Variation in different parts.—When the surface treated is situated over loose tissues—for example, near the eye—there is often great swelling of the neighbouring parts, so that the eyes may be nearly closed.

Duration.—A preliminary hyperæmia with slight redness is followed by excoriation of the skin, and oozing of serum. Sometimes a blister is formed, which bursts and dries, to form a thick yellow crust at about the end of a week, and in ten days or a fortnight the sore has completely healed.

Constitutional effects.—These are practically *nil.* In a few cases under our care existing headache or neuralgia has been slightly aggravated. In two cases

the applications have been followed, an hour or so after treatment, by a peculiar sensation, not amounting to pain, in the head. Occasionally a slight feeling of giddiness is experienced on rising from the lying posture. In one case, treatment of an ulcer on the nose and inner canthus of the eye caused referred pains on the vertex, evidently through the nerves underlying the ulcer.

Effect on the eyes and on the nasal mucous membrane.—In several cases treated by us the inner or outer canthus or the lids were involved, but there has been no deleterious effect upon the eye itself. Although the eyes are carefully covered up, the light can still be seen by the patient through the protecting wool and brown paper, and slight running of the eyes has been observed in a few patients.

In several cases in which the skin of the nose was treated, improvement took place in the mucous membrane, and in one case the sensation of smell was said to have been greatly improved. As the cavities of the nose or mouth are lighted up when the light is applied to the exterior, it is possible that there may be some slight effect of this kind.

Advantages of the treatment.—The advantages are the excellent cosmetic results; no bad scar or disfigurement results from the continual applications; no anæsthetic is required; no injurious effect is produced on the general health; and to these advantages is to be added the trustworthiness of the method—improvement may be expected in all cases, provided sufficient time is given to the treatment.

Disadvantages of the treatment.—The disadvantages are the great length of time required—the

patient must be kept under observation for several years; the tediousness of the treatment for nearly one hour daily and the loss of time which it involves; the occasional pain during the application; the inconvenience and pain caused by continual inflammatory reaction in parts treated; the expense of outlay and working.

Unfavourable conditions—The following conditions are unfavourable for the treatment:—

1. Factors which hinder penetration of the light, and thus prevent a good reaction. Among these are pigmentation, dark complexion, and thick skin; great depth and infiltration of the disease; scarring from previous treatment; great vascularity of the parts.

2. Great extent of the disease.

3. Inaccessible position, *e.g.* the mucous membrane of the nose.

4. Certain general factors not specially applying to the light treatment. Among these are:

(*a*) Age. In general terms, the older the patient the worse the prognosis.

(*b*) Sex. Males, as a rule, cannot give up sufficient time to the treatment.

(*c*) Predisposition. A marked family history of tuberculosis is somewhat against the patient, as are other tubercular tendencies or manifestations in the patient himself.

(*d*) Occupation. Unhealthy surroundings or dirty occupations make septic infection probable and also reduce the vitality of the patient's tissues.

Reinforcement of the treatment.—The light treatment often requires to be reinforced in various ways. Thus in cases where the disease is very extensive

or where there is much infiltration, scraping followed by X-rays may usefully be employed as a preliminary to the application of Finsen's method; or the X-rays alone may first be used and followed up by the Finsen treatment. The X-rays may also be combined with Finsen's light treatment. These methods may be further reinforced by the application of caustic remedies, such as pyrogallic acid or pyrogallic acid and salicylic acid followed by X-rays or Finsen. The same applications may be followed by X-rays or Finsen before healing has taken place. Weak ointments of the same caustics may also be used simultaneously with Finsen's method.

Therapeutic results.—The greatest triumph of the Finsen light has been in the treatment of lupus vulgaris. From November, 1895, to January 1, 1902, the total number of cases of cutaneous tuberculosis treated at the Copenhagen Light Institute was 804. Of these 412 were reported cured, 124 had been free from recurrence for two to six years, and 288 for less than two years, 192 were nearly cured (only insignificant remains of the disease being left). There were still 117 under treatment: of these 91 were materially improved or partly healed, 26 more or less influenced by the treatment. Under the head of interrupted treatment (course not completed) were placed 83 cases. In 16 of these the treatment was discontinued because no satisfactory result was obtained; in 31 on account of the death of the patient; in 12 on account of serious intercurrent disease; in 23 on account of "other circumstances." Deducting the 67 cases in which treatment was interrupted by death, intercurrent illness, or other circumstances, there remained 737 cases as a basis for the estimate of the

efficacy of the treatment. Of these the result is said to have been unfavourable in 42, and favourable in 695. The percentage of successes claimed by Finsen was therefore 94, while that of failures is only 6.

Gastou, Baudouin, and Chatin (*Annales de Dermat. et de Syph.*, April, 1902) reported 121 cases of cutaneous tuberculosis treated at the St. Louis Hospital in Paris. Of 30 cases in which the treatment was completed, 11 were entirely and 12 partially cured; in 7 there was no result. Leredde and Pautrier (*ibid.*) reported 8 cases completely cured and 7 almost cured out of a total of 43, the rest being still under treatment. Favourable results have also been reported by Sequeira, Gelbowsky, Ullmann, Forchhammer, Max Helm, Veljaminoff, von Ziemssen, Du Castel, Schmidt, Petersen, and others.

Many other diseases are benefited by the Finsen treatment, although to a less extent than lupus vulgaris. We have treated a considerable number of cases of lupus erythematosus, in nearly all of which some improvement took place. In the preulcerative stage of rodent ulcer we have had good results, although relapses have occurred. We have also found a few applications of use in softening the indurated edge previous to or concurrently with X-ray treatment. In small warty growths of doubtful nature in which the development of rodent was feared we have found the Finsen light of the greatest service. In several such cases a few applications have removed the lesions, and the need for excision has thereby been avoided without the risk of irritating the growth. In some cases of pigmented moles and seborrhœic warts we have had equally good results. Excellent results have also been achieved in rosacea, alopecia

areata, and capillary navi, and the treatment has been employed advantageously in a case of vitiligo (Montgomery), in localised eczema, chronic ulcerations, actinomycosis, adenoma sebaceum, acne pustulata (Harrison and Wills), and rhinophyma (Leredde).

London Hospital statistics.—The following are the statistics of the Light Department of the London Hospital given by Sequeira in a paper on "The Comparative Value of the Old and New Methods of Treatment of Lupus Vulgaris and certain other Skin Diseases," read at the meeting of the British Medical Association at Oxford in July, 1904:*—

The department was opened in May, 1900, and the total number of patients treated up to July, 1904, was 539.

COMPLETED CASES.

Patients known to be well to date:	
Discharged in 1900 and 1901 . . .	49
„ 1902	60
„ 1903	69
„ 1904 (half-year) . .	38
	216
Patients discharged, but of whom no recent information had been obtained . . .	8
Died (2 from phthisis, 1 from general tuberculosis)	3
Cases found incurable by light after prolonged treatment	11
	238

* *Brit. Med. Journ.*, Oct. 15th, 1904.

Completed Cases (brought forward) . .	238
Incomplete Cases.	
Treatment suspended; under observation . .	43
Patients who left for treatment elsewhere .	22
Patients who left for other causes (domestic reasons, ill-health, &c.)	23
Treatment not completed (in a large number the skin was free from disease, but there were mucous membrane lesions requiring treatment)	213
	539

CHAPTER II

X-RAY TREATMENT: PRINCIPLES AND TECHNIQUE

Principles of the treatment—Effects upon the tissues—Pathological action—Action of X-rays on bacteria—Choice and care of tubes—Protection of the patient—Instruments of measurement—The radiogenometer—Distance of the tube from the patient—Details of exposure—Duration and frequency of application.

Principles of the treatment.—Until we know the exact nature of the X-rays, the cause of the pathological changes produced by them in the tissues cannot be satisfactorily explained. In some respects these changes resemble those brought about by ultra-violet rays, *e.g.* in small doses they act as a stimulant of the tissues, they can cause erythema, inflammation, and pigmentation of the skin. (It may be noted that prolonged exposure to sunlight can in some cases also cause atrophy of the skin and telangiectasis, but we have never seen this as the result of Finsen's treatment.) But the long latent period and cumulative action, as well as the greater severity of the reaction after prolonged exposure, are sufficient to distinguish the two series of changes from a clinical standpoint. Another point of distinction is, that whereas light has definite bactericidal properties, the X-rays, as we shall see, do not kill bacteria. The penetrating qualities of X-rays are much greater than those of light, and their action is chiefly manifested at

their points of entrance and exit from the body, *i.e.* on epithelial structures, for which they have a selective affinity. In addition to ultra-violet rays and the X-rays themselves, cathodal rays, electro-dynamic rays, heat waves, material particles driven off the anticathode, static discharges from the surface of the tube, and generation of ozone in the tissues have been adduced as contributing or exciting factors.

Effects of the X-rays upon the tissues.—The X-rays are known to have well-defined effects upon the tissues, depending upon the quantity of rays absorbed. They vary from a simple transient erythema to a deep-seated inflammation with sloughing, and all the stages of a burn or a frost-bite may be produced. They may be classified as follows:—

1. Mechanical effect without apparent reaction.
2. Temporary reaction.
3. Reaction with atrophy of skin.
4. Dermatitis with vesication.
5. Sloughing.

There is much uncertainty with regard to the immediate cause of these changes in the tissues. Neisser compares the action of the rays on the skin to the local reaction produced by tuberculin. Kaposi held that they acted on the blood-vessels, producing an alteration in tone, bringing about healing and absorption of the granuloma by fatty degeneration or molecular change. Scholtz experimented on various animals, and found microscopic changes consisting of swelling and œdema of the epithelial cells and clumping and shrinking of the nuclei with vacuolation of the protoplasm of the cells.

Mitoses were rarely seen, but many of the epithelial cells showed nuclei which seemed to be in process of dividing. There was marked œdema of the corium, its fibres being swollen and staining badly. The elastin was more resistant than the collagen. The connective-tissue cells were affected in a similar manner to those of the epidermis, as were also the cells of the sweat glands and hair follicles, and the intima of the larger blood-vessels. There was abundant inflammatory infiltration of cells, chiefly leucocytes. Masses of leucocytes were present beneath the epidermis. The mast cells in the corium were increased. Towards the centre of the lesions there were superficial vesicles in the stratum corneum. Scholtz concluded that the rays cause a slow degeneration of the cellular elements of the skin both of epidermis and of corium, the nucleus as well as the protoplasm being affected. There is also a less marked degeneration of the fibrous elements. As soon as the cellular degeneration reaches a certain degree an inflammatory reaction occurs in which the blood-vessels become dilated, and there is an extravasation of serum and leucocytes. The latter seem to act as phagocytes, and completely destroy the degenerated cells. The microscopic changes caused by the reaction of the X-rays on the tissues in various pathological conditions are referred to elsewhere.

Pathological action of X-rays.—Carl Beck* described the pathological tissue changes of three stages corresponding to those of a burn.

In the *first degree* these are hyperæmia, exfoliation in scales, infiltration of inflammatory cells, and itching. These are accompanied by falling out of hairs and de-

* See MacLeod's paper in the *Brit. Journ. Derm.*, Oct., 1903.

generative changes in the more differentiated structures, such as hair follicles, glands, and nails.

In the *second degree* the inflammatory reaction is more acute and vesiculation is present.

In the *third degree* there is an escharotic destruction of the irradiated tissue.

Beck noted a thickening of the tunica intima of the blood-vessels, and he regarded the whole process as the result of a chronic inflammation associated with colloidal degeneration of the elements of the tissue.

In an examination of sections of an X-ray ulcer, MacLeod found that on the surface the epidermis had broken down and been replaced by *débris*, partly formed of disintegrating epidermal cells and partly of leucocytes. Beneath this, in the corium, the blood-vessels were dilated and almost cavernous, and in places their endothelial lining had given way.

In a communication on "The Rationale of and the Indications for the Therapeutic Use of Röntgen Rays," read by Pusey, of Chicago, before the twenty-seventh annual meeting of the American Dermatological Association at Washington in May, 1903, and published in the *Journal of Cutaneous Diseases*, he summarised the changes produced by the rays on the skin as follows: First there is a hyperplasia of the prickle-cell layer, followed by a breaking up of the nuclei, a division without mitoses, and finally a degeneration of the cells. Similar changes occur in the cells of the hair follicles and glands, leading to atrophy. In the corium there is an ordinary inflammatory reaction, with œdema and swelling of the fibrous elements. These are two changes which occur in the healthy skin, and they both

point to an irritant of an unusual character which is capable of causing a degeneration of the more highly differentiated elements of the tissue, such as the hairs and glands, while it has at first a stimulating effect on the epidermis itself. In pathological states, such as carcinomata of the skin, he found that the diseased cells were destroyed and a fragmentation of their nuclei took place. The blood-vessels in the neighbourhood were affected, and an endarteritis seemed to have been produced which almost obliterated the lumina. These specific changes in the vessels did not precede those in the diseased epiblastic cells, showing that the latter were independent of inflammation. The healthy stroma around the cancerous infiltration was only slightly implicated, and was capable of recovery, as it is after exposure to the actinic rays.

The following tentative propositions are formulated by MacLeod (*Brit. Journ. Derm.*, Oct., 1906) as fairly representative of the present state of our knowledge of the subject:—

1. That the X-rays in small doses have a stimulating effect on the elements of the healthy skin.

2. That in large doses, by long exposures, close proximity of the tube to the skin, or the employment of soft tubes,* the rays are capable of devitalising the tissue-elements, interfering with the process of reproduction and causing their degeneration; and that this power is the result of a direct specific action of the rays.

3. That the more highly differentiated structures, such as the hair-follicles, glands, nails, and blood-vessels,

* This is leaving out of consideration the undecided problem of the possible difference in the type of the rays obtained from hard and from soft tubes.

are more readily and severely affected by the rays than the less differentiated epidermal cells or the fibrous stroma of the corium.

4. That pathologically altered cells, whether of epiblastic or mesoblastic origin, are far less resistant to the rays than healthy cells, and are devitalised with small doses of the rays; and that this destructive action on diseased elements may be taking place while the healthy elements in the neighbourhood, instead of having their vitality inhibited, may be stimulated to a process of repair.

5. That the action of the rays is cumulative, and that when the cellular degeneration reaches a certain degree, the toxic products of the breaking-down cells are capable of setting up an inflammatory reaction, which is a secondary phenomenon.

6. That this inflammatory reaction is peculiar in that it occurs in a tissue the vitality of whose various elements has already been impaired by the action of the rays, and, in that it is associated with greater destructive changes than those produced by the actinic rays, is apt to lead to ulceration and necrosis, and is liable to be followed by an imperfect process of repair.

Action of X-rays on bacteria.—The majority of observers agree that the X-rays in therapeutic doses are not bactericidal. Wolfenden and Ross experimented with twelve different varieties of bacilli and cocci, and came to the conclusion that it is impossible to hinder their growth by exposure to the Röntgen rays. When destruction occurs they attribute this to exhaustion consequent upon excessive growth of the organisms rendering further development impossible. In their experi-

ments they were careful to exclude as far as possible all adventitious factors, such as the production of ozone or other atmospheric changes, rise of temperature, chemical or other alterations in the culture medium and rays of ordinary light.

Scholtz inoculated guinea-pigs with tubercle bacilli and exposed the animals to X-rays, but did not find any appreciable influence except that the inflammatory reaction was less marked on the irradiated side.

Rieder, on the other hand, found that cultures of cholera, anthrax, diphtheria, tubercle, and staphylococci and streptococci flourished upon that part of the plate sheltered from the rays, while in the exposed part the organisms were either absent or feebly developed. He also found that inoculated tuberculosis was arrested, and in many cases the general infection was retarded, although in spite of this the animals succumbed.

The discrepancy in the results obtained is attributed by Belot* to the quantity of radiations absorbed, some experimenters giving strong and others weak exposures; in the former case the bacteria would be affected. He concludes that X-rays do destroy the vitality of bacterial cultures, but that in order to do this they must greatly exceed the maximum dose permissible in radiotherapy.

Our own experience, using daily exposures of about the same strength, but longer than we should employ for therapeutic purposes, led us to the conclusion that there was never an inhibitory but sometimes a stimulating effect upon the growth of bacteria. Cultures of micrococci, bacterium coli, typhoid bacilli, and yeasts were exposed to the rays, for varying periods, through an aperture in

* "Radiotherapy in Skin Disease."

the lead-foil with which the tubes were covered. In most instances no difference was detected between the exposed and the surrounding areas, or between exposed and control tubes, and sub-cultures grew well, but in a few tubes containing yeasts the cultures seemed to grow more luxuriantly under daily exposures to the rays for periods of from 10 to 30 minutes for two or three weeks.

Clinically, microbic infections such as pustular sycosis are markedly benefited by short exposures, but it must be remembered that the conditions are very different from those obtaining in test-tube experiments, and it is probable that living tissues are stimulated by the rays to deal with the invading organisms.

In the treatment of ringworm of hairy parts the rays have no destructive effect upon the fungus, and cultures may easily be made from the hairs that are shed.

Choice and care of tubes.—For radiotherapy a tube is required which will give a uniform output of rays for considerable periods at repeated intervals. The vacuum of a new tube is often too low or too high, or becomes so when worked on a coil different from the one used in the process of exhaustion. It is therefore advisable to choose a fairly low or soft tube, and to tune it up on one's own apparatus by frequently passing a small current through it until the desired state of vacuum is reached. As a tube tends to become harder with use, many devices for lowering the vacuum have been tried. In our experience these are all more or less satisfactory up to a certain point, but they tend to lose their effect after the tube has been in use for some time. After having tried many varieties of tubes, we have found a simple non-regulating tube with a single anode as good

as or better than any regulating or bi-anodal or heavy anode tube. When the vacuum has become too high a slightly heavier current than that generally used will reduce the vacuum by making the anode red-hot, and the tube will remain constant for long periods by keeping the anode a dull to a bright-red colour and varying it as required.

We have had several of these tubes in constant use for a year or more without re-exhaustion being required and without any of the troubles often associated with the regulating and heavy anode tubes. It is advisable to have several tubes in stock in order that too much work may not be thrown upon one or two, and that a tube of the required degree of vacuum may always be at hand. Other methods for lowering the vacuum are heating over a spirit-lamp, or baking in an oven; or putting the tube aside for a time will sometimes effect a change in the vacuum. Occasionally, especially in a new tube, owing to the tube having been overworked or to atmospheric changes, the vacuum will suddenly fall, and some means is required to bring it up again. This may be accomplished by introducing a spark-gap in series with the coil, by reversing the current for a few moments —a method not to be recommended, on account of the blackening of the glass by platinum particles—or by discarding the tube for a time and occasionally running a small current through it. Sometimes the vacuum cannot be restored, and the tube then requires re-exhaustion.

Protection of the patient.—The lead glass shield is a great improvement on the old method of using lead masks, and the circular opening to which lead glass cylinders of varying diameters may be fixed, limits the

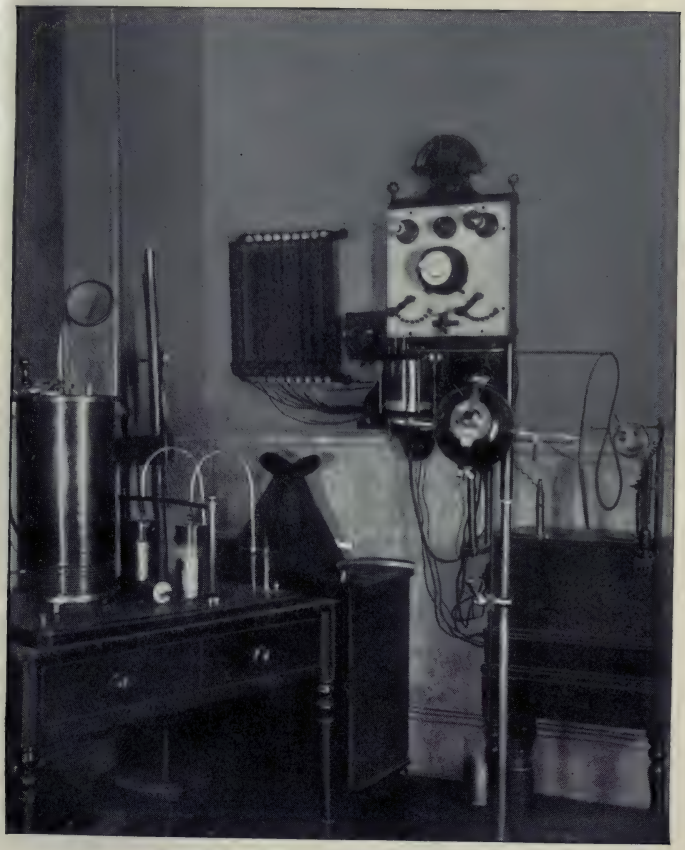


PLATE II. X-RAY AND HIGH-FREQUENCY APPARATUS.

field exposed to the rays. It also protects the operator without hiding the tube—both important points; the former on account of the serious consequences which constant exposure to the rays has had upon some radiographers; the latter because the appearance of the tube forms a useful indication of the character of the rays emitted from it.

In order to measure the penetration of the rays, Benoist's radiochromometer, in which the illumination of a number of aluminium sectors is compared with that of a central disc of silver, is usually employed. In a convenient modification of this, a number of discs of varying thicknesses are made to revolve so that each may be compared in turn with a standard disc.

A rheostat should be used in the primary circuit and the current measured by means of an ampèremeter and voltmeter. A milliampèremeter in the secondary, although it does not give a true reading, is a useful indication of the amount of current passing through the tube.

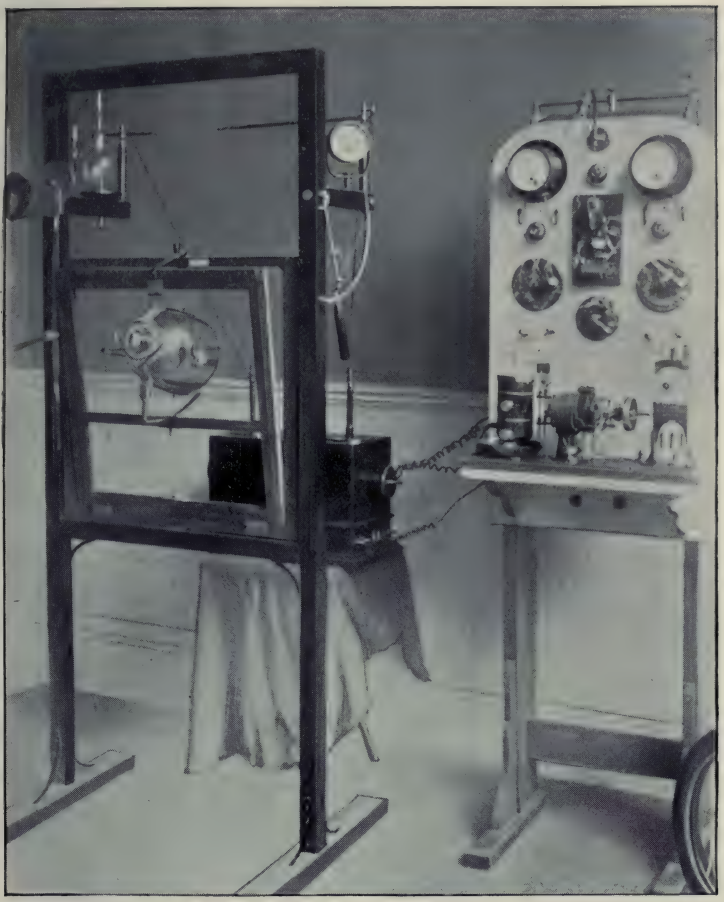
Instruments of measurement.—The pastille of Sabouraud and Noiré will be described in the chapter on the treatment of ringworm. It is important that the standard water-colour tint of the control pastille be correct, as in some the B tint is much too dark. A pastille-holder may be conveniently fitted on the lead glass shield referred to, but it must be placed at the correct distance from the anode if accurate results are to be ensured. In Holzknecht's radiochromometer the pastilles are placed at a distance equal to that of the patient's skin, and the change in colour is compared to that of a graduated scale of 12 degrees, each degree

being termed by Holzknecht 1 H. 5 H is the maximum amount that can be given with safety at one exposure, and corresponds to Sabouraud's teinte B. Holzknecht's radiometer is not much used in this country on account of its expense and the difficulty of obtaining the pastilles, the composition of which is secret. Kienböck's quantimeter is not of much practical value, owing to the fact that a strip of sensitised paper has to be developed before a reading can be obtained.

The radiogenometer.—A convenient apparatus suggested by Dr. MacLeod, and called the radiogenometer (Plate III.), consists of a dome-shaped lead glass shield completely enclosing the tube and fitted on to a square wooden frame-work, supported on casters. An internal arrangement of frames allows the position of the tube to be adjusted by downward vertical and lateral movements, so that it can be lowered for the treatment of a child on a couch. By means of the addition of a quadrant we were able to obtain an upward vertical movement, so that patients could be treated more easily in a sitting position. The radiogenometer is fitted with a radiochromometer, milliampèremeter, adjustable spark-gap, and a pastille-holder. A speed counter is supplied with the mercury dip interrupter, and the number of interruptions registered on a dial, and an automatic cut-out is arranged so that the apparatus can be set for a given number of interruptions.

Distance of the tube from the patient.—As pointed out by Belot,* the correct distance of the tube from the skin of the patient is fixed by the size of the surface to be treated. By applying the laws (*a*) that

* *Op. cit.*



RADIOGENOMETER AND SWITCHBOARD, AFTER MacLEOD (DEAN).

PLATE III.

the quantity of light falling normally on a given surface varies inversely as the square of the distance of that surface from the source of light, and (*b*) that the quantity of light falling obliquely on any surface varies as the sine of the angle which the incident ray makes with the surface—laws which are applicable to Röntgen as well as to light and heat radiations—it follows that the distance must always exceed twice the greatest diameter of the area to be treated if an equable therapeutic effect is to be procured at all points. When the diameter is equal to the focal distance, the intensity of irradiation at the edges is not more than three-quarters of that at the centre, and in order to obtain the same results at the edges as at the centre, the former would have to be irradiated for one-third as long again as the latter.

This, however, is only true for plane surfaces. When the surface is convex the distance from the source to the points further removed from the centre will increase more rapidly, and the inclination of the rays to the skin will be more acute than with a plane surface.

For the reasons given above it is advisable not to treat large areas, and especially convex areas, at one sitting, but rather to divide them up into smaller areas and treat each separately. This is advised by Sabouraud in the treatment of ringworm of the scalp, where it is not uncommon to obtain complete epilation in the centre of a large irradiated patch, and incomplete epilation at the periphery; or if a larger dose has been given there may be, with complete epilation of the periphery, a dermatitis of the centre. The importance of this point

is undeniable, and we have often seen it demonstrated in practice. On the other hand, by increasing the distance of the tube from the patient, we have frequently obtained complete epilation of large areas, *e.g.* the whole of one side of the head, without central dermatitis.

The correct distances may be obtained by having the lead-glass cylinder commonly used in this country made of a length proportionate to the diameter of the aperture, but we have usually employed cylinders of the same length with varying apertures, *i.e.* giving a total distance of 15 cm. from the anticathode, which is sufficiently correct for practical purposes when areas up to a diameter of 10 cm. are treated.

Details of exposure.—We have found a 12-in. coil—of which we have two in use—satisfactory for therapeutic purposes. We have worked with both a mercury-jet and a mercury-dip break, each driven by means of motors connected to the main supply of 240 volts. The former gives greater rapidity of interruption, but this can be varied within wide limits by means of a rheostat in both breaks, although we have failed to detect any material difference in the therapeutic results from altering the periods of interruption. For ordinary purposes we use a current of 2-3 ampères in the primary, a tube giving an equivalent spark-length of about 4 in., penetration corresponding to about No. 5 of Benoist's radiochromometer, and a current of approximately $\frac{1}{5}$ milliampère in the secondary.

In giving these details we agree with Belot that the important point in radiotherapy is the quality of the rays emitted and the quantity absorbed by the skin.

The voltage and ampèrage, number of interruptions, &c., are merely accessory circumstances which are useful for a given apparatus, since while they remain constant the output will not vary; but they must not be regarded as data of primary importance.

Duration and frequency of applications.— The duration necessarily varies with the apparatus employed, with the strength of the current, with the distance of the tube from the patient, and with the interval between the exposures. The same result can be obtained in five as in fifteen minutes by varying the conditions of the exposure, and these times can be reduced or extended in either direction. Some operators prefer to give massive doses, or the maximum dose that the skin will take, with long intervals between the exposures; others prefer to divide the maximum dose into a corresponding number of fractional doses, or short exposures, repeated daily, or once, twice, or three times weekly, without making any attempt at mathematical exactitude, but adapting the applications to the nature of the disease and the comfort of the patient. When fractional doses are given it must be remembered that the effect of a single large dose is much greater than that of a corresponding number of small doses with an interval between them. Thus, if an exposure of twenty minutes is sufficient to cause epilation, six or more exposures of ten minutes, amounting in the aggregate to an hour, may be required to produce the same effect when they are spread out over a week or fortnight.

In practice we prefer to give short exposures frequently repeated, rather than large doses at long intervals. The patient is then kept under observation; there

is less danger of exceeding the required dose; and the therapeutic effect upon chronic diseases, such as lupus, seems to be better. Moreover, it follows, from what we have said above, that a larger aggregate dose may in this way be given without setting up a dermatitis Massive doses may be sufficient to cause a dermatitis without being sufficient to cure the disease.

CHAPTER III

X-RAY TREATMENT (concluded): THERAPEUTIC EFFECTS

Is reaction necessary?—Idiosyncrasy—Variability of the reaction—Physiological and pathological factors—Technical factors—General effect of the rays—Therapeutic advantages—Disadvantages.

Is reaction necessary?—There is some difference of opinion as to the necessity for producing a reaction with X-rays. Our own view is that the therapeutic effect, as in the case of the violet rays, is greater when an inflammatory reaction occurs; but that visible signs of reaction are not essential for the production of marked changes in the tissues is shown when epilation occurs without erythema, or with only a slight transient redness of the skin. In lupus a severe reaction should be avoided on account of the greater tendency to the production of telangiectasis after repeated reaction, and this also applies to the treatment of hypertrichosis and of other diseases where cosmetic results are important. In rodent ulcer, unless other means, such as Finsen light and the cautery, are adopted, it is sometimes necessary to set up a certain amount of reaction before the hard edge can be removed.

Idiosyncrasy.—In a few of our cases there has been a marked susceptibility to the action of the rays, but in

none of them could a true idiosyncrasy be said to exist. In practice, at any rate with weak exposures, it may be neglected, and we have never found it necessary to give a trial exposure as advocated by Freund and Scholtz. Otherwise it would be impossible to treat ringworm of the scalp after Sabouraud's method, with massive doses, without great danger of injurious consequences.

What we have often observed is an increasing susceptibility to the rays during treatment, and especially after a reaction has occurred. On the other hand, a few of our patients seemed to become less easily affected.

A transient erythema is sometimes seen during and after the first few exposures, but this is distinct from a true reaction, and does not necessitate a suspension of the treatment.

Variability of the reaction.—Even with improved methods of regulating the dose, the reaction from X-rays is much more variable than that from the Finsen light, which, as we have already pointed out, is practically uniform in its time of onset, intensity, and duration. There may be no visible reaction from short exposures to X-rays, or the inflammatory phenomena may vary from a slight transient erythema to deep-seated inflammation of considerable duration, or ulceration and necrosis of the tissues may result from excessive doses.

The X-ray reaction differs from that of the Finsen rays also in having a much longer latent period—varying inversely as the strength of the dose (Kienböck); except in its very slightest degree, the skin is of deeper red and may be purple in colour, and bleb-formation or ulceration or necrosis with scarring may ensue, according to the dose. Even in its mildest form the reaction is

usually much more prolonged than that from the Finsen light, the action of the rays being continued for a considerable time after the cessation of treatment.

The degree of reaction may depend upon certain peculiarities in the patient, or upon certain factors connected with the technique of the exposure.

Physiological and pathological factors affecting reaction.—The factors which we have already mentioned as hindering the reaction from ultra-violet rays apply, although in a less degree, to the reaction from X-rays.

1. *Colour of the skin.*—Patients with much pigment in the skin are, in our experience, somewhat less susceptible to the action of the rays than those with a fair complexion. Fair-haired children require a slightly smaller dose when treated for ringworm of the scalp, but the difference is not sufficiently marked to be of great practical importance.

2. *Texture of skin and part of body treated.*—Patients with thin, delicate skins are rather more easily affected, and this is perhaps why certain localities, such as the face, where the skin is thin and tense, are more sensitive than parts such as the scalp, where it is thick. Another cause might also be found in increased vascularity of the part, which in our experience seems to favour reaction both from the X-rays and from the Finsen light.

3. *Age and sex.*—Though we have not noticed much variation in susceptibility with the age or sex of the patient, and cannot confirm Belot's view that there is diminished susceptibility in old age, it is possible that children and women react more readily than adult

males, probably on account of the difference in texture of the skin.

4. *Morbid conditions.*—Diseased and degenerated tissues react sooner than the healthy skin. The presence of inflammation tends to intensify the reaction, and should be allowed to subside before exposing the part to the X-rays (*e.g.* painting patches of ringworm of the scalp with iodine).

We have noticed, on the other hand, that in some cases the presence of ulceration is to a certain extent a hindrance to reaction. The strength of the rays is, as it were, used up in stimulating the tissues to heal, and the breaking-down effect may be delayed until new epidermis has formed. This may perhaps be explained by the fact that the rays have less effect on connective than on epithelial tissues.

Probably for the same reason, scar tissue and sub-epidermic tissues show a less ready reaction.

Technical factors affecting reaction.—As shown by Kienböck, the degree of reaction depends upon the quantity of rays absorbed by the skin. According to Belot, this is only true so long as the quality of the rays remains unaltered. Sabouraud, on the other hand, contends that in the treatment of ringworm the quality of X-rays has no importance. If it be true that under certain conditions a tube may emit dangerous rays, or rays which are sufficiently active to cause a serious dermatitis before the colour of the radiochromometer has changed, or has reached the standard tint, the quality of the rays must be admitted to be an important factor. We have never experienced this danger in our practice, but we are familiar with the vagaries of new

and re-exhausted tubes and the variability of tubes with changing atmospheric conditions. The quantity and quality of the rays from a tube depend upon the degree of exhaustion of the tube and the strength of the current employed to actuate it.

Other factors which must be taken into consideration are the capacity of the tube and the coil, the kind of interruptor used, and the frequency of the interruptions.

The quantity of rays absorbed by the patient depends upon the time and frequency of exposure and the distance from the tube, as well as upon the nature of the disease and the personal factors already mentioned.

General effect of X-rays.—In our experience, this is practically *nil*. It is true that some of our patients have expressed themselves as feeling better during exposure to the rays, and it is possible that there is a slight stimulating effect, due to static discharges from the tube. On the other hand, not a few have complained of slight headache or sleeplessness, which they attributed to the exposures. One patient complained of "shocks" which made her start from the chair, and we attributed this at first to static effects from the lead mask used at that time, but on removing this the same complaint was made. On the whole we are inclined to attribute these effects to suggestion and mental impressions made upon the minds of neurotic subjects.

A more serious consideration is that which relates to the production of general toxic effects upon the patient. Apart from some slight constitutional disturbance resulting from the pain and inflammation of a severe reaction, we have never seen any symptoms, even when extensive

lupoid, rodent, or carcinomatous ulcerations have been treated, indicative of a general toxæmia.

One of our patients (*see* p. 108) developed a generalised dermatitis, which was apparently in part due to X-rays, but, as he had previously had small patches of eczema on the body, we incline to attribute it to the lowered resistance of the skin produced by repeated inflammatory reactions leading to a spreading of the eczema. He had been treated for several months for a rodent ulcer of the left inner canthus and side of the nose, and about six months after the cessation of treatment he developed an acute vesicular dermatitis—apparently excited by exposure to sun and wind—beginning in the area which had been the site of X-ray reactions, and spreading to the opposite side of the face and forehead. The dermatitis lasted a week or ten days, and was followed by scaling and pigmentation. Three months later he had a second attack, for which no cause could be found except exposure to sun and wind when golfing. It began in the left orbit as before, but this time spread over the whole body. The eruption resembled an artificial dermatitis rather than an acute eczema, and was attended with somewhat severe constitutional disturbance. In the treatment of ringworm of the scalp it is not uncommon to see a seborrhœic or pustular dermatitis.

Attention has been drawn to the occurrence of general toxæmia from the absorption of toxic products resulting from the breaking-down of malignant and other neoplasms under X-rays. Dr. White and Dr. Burns gave a *résumé* of the literature of the subject in a paper on "The Evolution of a Case of Mycosis Fungoides under the Influence of Röntgen Rays," read at a meeting of

the American Dermatological Association. As regards the case described by White and Burns, Dr. Pollitzer and other speakers raised the question whether the toxæmia was caused by the rays, in view of the frequent occurrence of death in the course of mycosis fungoides from streptococcus septicæmia.

It is in cases of malignant disease that toxic symptoms seem to have occurred most often. Nielsen reports four cases of septic absorption and death following X-ray treatment. Oudin observed symptoms of general infection in all cases of cancer treated by him, after the third or fourth exposure. Allen, Skinner, Gibson, Coley, Haret, Franklin and others refer to the toxæmia produced by the rapid disintegration of diseased tissues; and Williams, Franklin, Hall Edwards, and Lyle recommend drainage of a tumour after exposure to the rays.

Holzknecht observed three cases of fever and scarlatiniform dermatitis following exposures to X-rays, and Kienböck had three similar cases. Pusey mentions symptoms of toxæmia and a slight dermatitis in a case of lymphadenoma, and Dock refers to the occurrence of toxic symptoms in the treatment of leukæmia.

According to Linser the X-rays destroy the leucocytes, especially the lymphocytes, in the blood, with the production of a leucotoxin.

Advantages.—The employment of X-rays as a therapeutic agent has many advantages over other methods. As compared with operative procedures, anæsthetics and the pain subsequent to an operation are avoided. In the treatment of ringworm of the scalp much time is saved; in psoriasis the application of ointments

and the administration of drugs are done away with. In malignant ulcerations, pain is often relieved and discharge diminished; large rodent ulcers will heal in a way unattainable by any other known curative agent. In some severe cases of lupus and other diseases where active measures are contraindicated on account of advanced age, weak state of health, &c., small doses of X-rays exert a useful palliative effect. The antipruritic effect of X-rays is very marked, and their prophylactic use, as after operation for malignant disease, has been advocated by many writers. These are a few, but by no means all, the advantages afforded by X-ray treatment.

In comparison with the Finsen method, the X-rays are applicable to a far larger number of diseases, the individual exposure is shorter, much larger areas can be treated; the application is less tedious, is carried out by the medical man instead of by a nurse; less manual dexterity is required, the rays not requiring to be focussed upon a small spot, and no pressure being needed; there is no pain or inconvenience from the formation of discharging surfaces (except in the case of dermatitis), and no dressing is required. The method is also less costly, although the difference is not so great since the introduction of the Finsen-Reyn lamp, for not only is the initial cost of this apparatus less, but only one nurse is required, and the amount of current consumed is much smaller.

Disadvantages.—These are chiefly due to the long latent period preceding reaction and to the want of exact means of measuring the dose, but they have been largely overcome of late years. Although, owing to the large

number of factors to be taken into consideration, it is still much more difficult to estimate the dosage of X-rays than it is in the case of the violet rays, the effects we endeavour to produce can be obtained with a fair degree of certainty. Serious radiodermatitis seldom occurs at the present time, and then only in inexperienced hands. The risks, however, are still great, especially when maximum doses are given, as in epilation or in the treatment of deep-seated and malignant diseases, in which small doses are useless. In the latter the rays have fallen short of the expectations formed of them, and their effect is chiefly palliative or only temporary. Nor do they convey any immunity against relapse in lupus, rodent ulcer, and many other diseases. Strong or oft-repeated exposures may lead to pigmentation or atrophy of the skin and the formation of telangiectases in the scar. Even epithelioma has been known to develop, especially as a result of the chronic dermatitis of X-ray operators. These are some of the serious disadvantages which must be taken into account before X-ray treatment is decided upon.

CHAPTER IV

RADIUM AND HIGH-FREQUENCY CURRENTS

Effects of radium on healthy skin—Radium in malignant disease and in lupus vulgaris—Disadvantages of radium. High-frequency—Local applications—General applications—Results of its use in 250 cases of skin affections

Radium

Effects on healthy skin.—The action of radium on the healthy skin was tested by us as follows:—An ebonite holder containing 5 mg. of radium was placed in direct contact with the skin of the forearm in three persons every day for a fortnight, the applications varying from 10 to 30 minutes, and averaging about 20 minutes daily.

The effect was similar in all three cases. During the exposure a slight pricking sensation was felt, and this was followed in a few hours by slight reddening of the skin of the area exposed. The redness faded on the third day, but a faint coloration persisted. At the end of a week the redness became more intense and the skin slightly œdematous and swollen, presenting the appearance of an erythema papule. In ten days a vesicle appeared in the centre of the area, accompanied by considerable itching, and on the next day this began to discharge and ulcerate. In about a fortnight there was a definite minute ulcer, which was painful on pressure

and caused a soreness or burning sensation of the part. The ulceration healed in about ten days, but in two of the cases was repeated several times at intervals of about a week, and the soreness and burning sensation, with slight redness of the skin, recurred from time to time for several months after. In all three cases a white depressed scar formed, with pigmentation at the periphery, the pigmentation being followed by a well-marked band of telangiectasis surrounding but not invading the scar.

The long latent period, the painful ulceration, the long-continued action, and the resulting pigmentation and telangiectasis are closely analogous to the phenomena associated with an X-ray "burn," and suggest that the therapeutic effect of radium is practically that of an intense localised X-ray reaction.

Radium in malignant disease. — In the treatment of certain forms of malignant disease radium has undoubtedly a place, and it has been successful where X-rays have failed. This may be in part due to its great penetrating powers, and also to the fact that it may be applied in small cavities not directly accessible to the X-rays, or in situations where the rays may be inadvisable, such as the neighbourhood of the eye. Successful results in rodent ulcer have been reported by Sequeira, Mackenzie, Davidson, Hartigan, Scholtz, Hölzknecht, and others. Sequeira treated a case in which radium was successful after the X-rays had failed, and refers to another case in which no improvement was manifest under the X-rays, but which radium seemed likely to cure.

In other forms of malignant disease, radium, either

applied externally or embedded in the tissues, has not fulfilled the expectations formed of it. Plimmer analysed 17 cases of carcinoma treated by it, and concluded that only young and rapidly growing cells are acted upon, the older cells, especially if surrounded by fibrous tissue, being but very slightly affected. But in melanosarcoma good results have been recorded by Holzknecht, Exner, and Gussenbauer.

Radium in lupus vulgaris.—Holzknecht, Scholtz, Hartigan, and others have been successful in treating lupus vulgaris with radium. In several cases we have seen the disappearance of nodules of lupus after 15 to 20 exposures of 5 mg. of radium for 10 or 15 minutes, but it seems probable that to produce this result the radium must be applied for sufficiently long periods to cause ulceration, and the resulting scar is not a good one. The limited action of radium makes it useless in cases of extensive lupus, but it can be used, as we have said, in cavities—such as the upper nasal passages—where it is difficult to obtain the direct action of the X-rays.

In using radium for therapeutic purposes, it must be remembered that there is a long latent period, and that the exposed tissues become radioactive, the effect continuing for a considerable time after exposure.

Disadvantages.—The disadvantages of radium from the therapeutic standpoint are the high price, the small area covered by the quantity usually employed, the variation in radioactivity of different specimens, and the consequent uncertainty of action of a given sample until it has been therapeutically tested. Another serious drawback is the persistent and painful ulceration which

may follow excessive exposure, and the resulting discoloured and telangiectatic scars.

High-Frequency Currents

Local applications.—In dermatological practice high-frequency currents may be applied locally either by means of glass vacuum or liquid containing electrodes or condensing electrodes of various shapes and sizes placed on or close to the skin, or by means of a metal electrode giving a soft brush discharge or "*effleuve.*" In some vacuum electrodes in which a metal terminal is inserted, X-rays may be given off, but owing to the difficulty in keeping the electrode at the proper degree of exhaustion this cannot be depended upon as a constant source of X-rays, and the latter are insufficient in amount to produce the characteristic effects of an X-ray tube.

General applications.—General high-frequency may be administered to the whole body by means of a condensation couch in which the patient's body forms one plate of a condenser (auto-condensation), or by placing the patient in a large cage or solenoid in which he receives the current by induction (auto-conduction). Local and general treatment are often combined, the patient receiving local treatment on a condensation couch.

The *general effects* claimed for the high-frequency are:—

1. Increase of metabolism.
2. Changes in arterial tension.
3. Diminution of toxicity.
4. Anæsthesia.

At first there is a tonic or stimulating effect, which may be followed by slight temporary exhaustion, and often by a feeling of drowsiness and a tendency to sleep. The benefit to the general health may be due in part to the stimulation of the skin and the profuse perspiration which is often set up.

The *local effect* depends upon the kind of electrode used and the distance it is placed from the skin, which, if the electrode be held close to but not touching it, receives a shower of spark discharges accompanied by a pricking or burning sensation and the production of a transient erythema. Vesication may be produced if a strong discharge be applied for a sufficient length of time. For local treatment, however, a glass electrode is usually placed in contact with the surface and the *effleuve* at a considerable distance from it, so that the effect is that of a mild brush discharge. The first effect is to produce some contraction of the blood-vessels, which is followed by dilatation.

According to Allen the vasomotor effects are well seen in urticaria, in which sparking causes blanching and entire disappearance of a wheal, succeeded within a few minutes by a reactionary hyperæmia.

Efficacy in certain cutaneous affections.—Although our own experience does not warrant us in confirming the claims made for high-frequency treatment by some writers soon after its introduction, we have found it of distinct service in some cutaneous affections. In conditions caused or accompanied by peripheral circulatory disturbance the effect is sometimes very marked. Such are persistent chilblains, lupus erythematosus, erythema multiforme, and Bazin's disease, in all of which

we have had good results. Pruritus and pain are often relieved; on the other hand, in several of our patients generalised pruritus and pain appeared to be aggravated. In some cases treated by us for various cutaneous affections, concomitant arthritic pains have been benefited, but in two cases of neuritis the pain was not relieved.

As a result of the study of over 250 cases of skin affections treated by high-frequency, Allen sums up its therapeutic uses in dermatological practice as follows:—

1. That in a comparatively large number of dermatological affections the local action of high-frequency currents aids in their cure.

2. That in a limited number of patients in whom nutrition is at fault D'Arsonvalisation or auto-condensation helps to bring about a prompter removal of local lesions.

3. That in parasitic affections, while it has an influence, it is doubtful if the results are prompter or better than those of older methods.

4. That the broadest field of usefulness is in the markedly pruriginous affections and in those intimately connected with the nervous system and associated with pain.

5. That an important and a growing sphere is filled by the high-frequency spark in the almost painless destruction of the small neoplasms, including nævi, moles, warts, tumours, and malignant growths, as well as in lupus and lupus erythematosus.

6. That, compared with the Röntgen ray, skin affections as a whole are less benefited by these currents, but

that the effects of the two methods are often mutually enhanced.

In addition to the skin diseases already mentioned, Allen has had good results in 28 cases of eczema. Oudin, Grubbe, and Williams speak well of the method for psoriasis. Jaquot, Leredde and Pautrier, Bisserié and others have treated lupus erythematosus with success in a considerable proportion of cases. In lupus vulgaris Allen says that individual nodules can be as painlessly, promptly, and permanently removed by sparking as by any other method with which he is familiar. Strebel also reports successful results. Allen found the application of the glass electrode useful in the relief of herpes zoster.

High-frequency currents may be employed in alopecia for their stimulating effect on hair growth, but in our opinion it is doubtful if the therapeutic effect is greater than that obtained by the use of lotions and ointments. Other skin affections enumerated by Allen in which high-frequency currents have been found useful are acne, sycosis, molluscum contagiosum, impetigo, warts, cheloid, atrophy of the skin, pityriasis versicolor, and pigmentation.

CHAPTER V

TREATMENT OF LUPUS VULGARIS

Light treatment of lupus—X-ray treatment—Effect of the rays upon mucous membranes—Their palliative use—Tendency to relapse after ray treatment—Sequelæ of severe reaction—Microscopical changes in lupus after radiotherapy—Selection of method for treatment of lupus

The light treatment of lupus.—The light treatment of lupus vulgaris, which we owe to Finsen's indomitable perseverance, has long passed through its period of probation in Denmark and other countries. A retrospect of our experience, extending over seven years, enables us to place the method in its true perspective, and to confirm in large measure the good results claimed for it by its introducers. We do not consider that Finsen's method is necessarily the best for all cases, but in certain types of the disease it is unequalled, and when combined with other measures it is probably the best all-round treatment for the majority of cases of lupus. In our opinion it is in non-ulcerative lupus of limited extent affecting the face, and especially in untreated cases, that it has the greatest sphere of usefulness. Surgical measures may be quicker, but they are attended by a certain amount of disfigurement and an equal liability to relapse. With X-rays there is great

difficulty in eliminating residual nodules, and the resulting scar is apt to become telangiectatic.

The presence of cicatricial tissue resulting from previous surgical treatment is a hindrance to the penetration of the light rays, and in such cases we have found repeated consecutive applications to a single area to be quicker, though more painful, than when the inflammatory reaction is allowed to subside between each exposure. In a patient under our care with lupus embedded in dense hypertrophic bands of fibrous tissue the treatment of different foci each day proved almost useless, but when the part was prevented from healing by constant exposures to the raw surface the lupus nodules rapidly disappeared.

In cases of large extent affecting the greater part of one or both cheeks or about one-third of the skin of the face, the duration of the Finsen treatment unaided is apt to be unduly long. We have found that preliminary exposures to X-rays over the whole or a large part of the affected surface give better initial results than the light, adaptable as the latter is to such a small area. In this way the disease can be, as it were, reduced to its lowest terms, and the margin of the patch or isolated nodules in it can be subsequently treated with Finsen's method. In some severe progressive cases we have employed the two methods simultaneously, and have thus been able to cope with the rapid spread of the disease.

As many cases of lupus originate in the mucous membrane or form foci for possible inoculation, the fact that Finsen's rays cannot be applied to most of the mucous surfaces detracts from the value of the method

as a whole. In spite of the excellent results that can be obtained by the use of the Finsen light, it must be admitted that there are some cases in which the time required before final resolution of the disease is obtained is so great as to make the treatment impracticable, even when aided by the use of X-rays and pyrogallic acid. In these cases, the infiltration being deep and extensive, nothing short of thorough operative procedures can remove the bulk of the disease in a reasonable time. In one of our patients, for instance, whose skin was not only densely and extensively infiltrated with lupus, but also naturally dark in colour, four years of almost daily treatment failed to remove the disease, and had we anticipated such a long and trying ordeal for the patient we should have scarcely been justified in advocating it. Without detracting from Finsen's brilliant results, we may partly attribute them to the systematic employment of mercurial compresses and strong pyrogallic acid ointment; to the larger number of applications per diem that may be given; and to the fact that the patients go to a healthy climate and surroundings prepared to give up everything to the treatment, instead of following their usual avocations in an unhealthy environment, as has usually been the case with the patients under our care.

X-ray treatment of lupus.—Although we have treated the majority of our cases of lupus vulgaris with the Finsen light, the X-rays have mainly been employed as a preliminary in cases in which there was extensive ulceration or considerable œdematous thickening. The effect of the rays in bringing about *rapid healing of ulcers* has in our experience been so marked that we

look upon ulceration as a definite indication for their use. Their drying effect is particularly striking. Even one application often causes a notable diminution in the discharge from an ulcerating surface; this fact suggests that extraction of moisture from the part may be an element in the healing properties of the rays. In cases of severe deep ulceration, relatively better results have been obtained than in slight superficial sores. This may be accounted for by the fact that in the deep ulcers little of the lupous growth is left and the new tissue is more healthy. When the ulceration is superficial, healing may occur over a mass of deep-seated lupus, and breaking down is more likely to occur. In a case in which there was severe ulceration of the mucous membranes of the lips and corners of the mouth, some improvement followed the continual application of the Finsen light, but permanent healing resulted from a few exposures to the X-rays. In another case a small superficial ulcer of the skin of the neck proved refractory to the light treatment, but the application of the X-rays produced rapid healing. In this instance, however, the healing was not permanent, and the ulcer had eventually to be excised.

Rapid absorption of œdema under the influence of the X-rays has been observed in several of our cases. In one in which there was marked œdema and protrusion of the upper lip with ulceration of its under surface and of the gums, the lip regained its normal shape and consistence, and the ulceration healed. In another case with ulceration of the angles of the mouth the upper lip was also tense and protruding owing to œdema, and the result of treatment with X-rays was

equally satisfactory. Improvement also took place in two cases of extensive œdema of both sides of the face, in one of which there was also œdema of the lobes of the ears.

Effect of the rays upon mucous membranes.—When mucous membranes (lips, gums, nostrils, &c.) are the seat of lupus, the X-rays are, in our experience, more effectual than the Finsen light. When the inside of the nostrils is involved there is indeed no choice, as the region is inaccessible to the light rays. In all such cases, therefore, we have used the X-rays. The *immediate* results have been very encouraging, obstruction being quickly relieved, discharge ceasing, and ulcers healing after a few applications. It is only after a long course of treatment, however, that results of any degree of permanency can be obtained, and the tendency to relapse is very marked. The disadvantages in the treatment of the nasal mucous membranes by X-rays are the impossibility, even when the nostrils are widely dilated, of directing the rays so that they shall fall perpendicularly on the affected surface, the inaccessibility of the upper nasal passages, and the small effect on the mucous membrane produced by raying the nose from the skin surface. We have treated only one case in which the palate was affected; it was extensively scarred from frequent scraping operations, and the X-rays produced very little effect upon the disease.

Palliative use of the rays.—Another point on which we wish to lay stress is the palliative use of the X-rays. Patients who, either owing to advanced age, ill-health, exigencies of occupation, residence at a distance, or other causes, are unable or unwilling to give

up much time to treatment, may get considerable relief from a short course of X-rays. More than once we have succeeded by this means in checking the spread of the disease.

Tendency to relapse after X-ray treatment.—Although the immediate effects of X-ray treatment, especially in cases in which there is extensive ulceration, are so good, our experience so far has been that the initial rapidity of improvement is unfortunately not maintained. Secondary conditions (ulceration, discharge, and œdema) are relieved almost at once; but in respect of eradication of the disease, progress is disappointingly slow and failure is not infrequent. Opinions differ as to the possibility of entirely destroying the granulomatous tissue. Although we have seen this accomplished in some cases, in many others nodules have remained after long-continued treatment, when the scar has already become telangiectatic. In non-ulcerative lupus the results seem to be less satisfactory as regards complete destruction of the foci of the disease.

Sequelæ of severe reaction.—Observers also differ as to the advisability of producing a reaction in the part. It seems probable that, unless a certain amount of inflammatory change be set up, there is little chance of permanent destruction of the granuloma, and that a somewhat severe reaction is more likely than a slighter reaction to bring this about. An intense reaction is, however, very painful, and the resulting scar is not only coarser and less supple, but is more subject to pigmentary and atrophic changes and the formation of telangiectasis. These subsequent changes in the scar form one of the chief objections to severe or prolonged

treatment with X-rays, and the development of epithelioma which has occurred in a few cases must be borne in mind as a possible complication. In this connection we would call attention to the fact that the formation of an epithelioma in association with lupus, possibly as the result of constant irritation from various destructive therapeutic procedures, was not a very rare event before X-rays were introduced, so that it must not be assumed that every malignant case is provoked by this agency.

In some of our cases marked improvement in the disease followed a somewhat intense reaction, but, even when this had been repeatedly produced, relapse occurred again and again. On the whole, therefore, we prefer to give mild applications and to avoid severe reaction.

Microscopical changes in lupus after radiotherapy.—By microscopical examination of fifteen foci at various intervals after exposure to the rays, Scholtz* found that they caused a great alteration in the character of the lupous nodule: the cells were swollen, and there were large numbers of leucocytes, especially polynuclears, between the plasma cells, with a number of exceptionally large giant cells. These giant cells finally degenerated, like the other cells, with the onset of the inflammatory reaction. According to Scholtz, "The action of the rays on lupous tissue is entirely similar to that on the normal skin: first, degenerative processes in the cellular elements and epithelioid cells of the lupous tubercles themselves, which are followed by the appearance of an inflammatory reaction. The healing of the lupus and the destruction of the

* *Arch. f. Dermat. u. Syph.*, Jan., Feb., and March, 1902.

bacilli result thus from the reactive hyperæmia and inflammation, and we can draw no deduction as to any bactericidal properties of the X-rays. The principal effect peculiar to the treatment of lupus by X-rays lies in the concentration upon the affected spot of the reactive inflammation which results from the degenerative processes induced in the tubercles. The reaction to the X-rays is similar to that induced by tuberculin, except that it extends over a long period of time."

Pernet describes a degeneration and disintegration of the fibrous elements of the corium in which the collagen is partly transformed into collastin; and also a degeneration of the cells of the hair follicles, sebaceous glands, and coil glands, and a destruction of the plasma cells of the granuloma.

From sections from lupus of the cheek treated for ten weeks with X-rays, Grouven describes a large formation of connective-tissue fibres surrounding and encapsulating the tubercles and running through them, with numerous spindle cells and evidences of new formation. The epithelioid cells and lymphocytes of the lupous tubercles show vacuolisation and loss of staining reaction, and degeneration of both nucleus and protoplasm.

He describes the course of healing of lupus as follows: "Hyperæmia, leading to increased diapedesis of leucocytes, first at the periphery of the nodules, pressing on into the interior, changing into spindle cells and new connective-tissue elements. The cells of the nodules undergo degeneration and absorption, and are replaced by connective tissue."

Selection of method for treatment of lupus.—We have already said that in our opinion the combina-

tion of Finsen light and X-rays in many cases gives better results than either of these methods used separately.

In non-ulcerative superficial cases of small extent the Finsen light alone is sufficient. If there is much infiltration, or scarring, the process of repair is sometimes hastened by a short course of X-rays after the nodules have been partly broken down by the light. If there is deep ulceration, fairly sound healing may follow the preliminary use of X-rays, any remaining or outlying nodules being then individually exposed to the Finsen rays.

In more extensive cases, in which Finsen treatment is apt to be very long and tedious, the X-rays may be used first, as a much larger area can be exposed; secondary conditions, such as ulceration and œdema, and some of the infiltration will then be removed, and the patch is in a better condition for the application of the ultra-violet rays. Moreover, the reaction from those rays is increased. Telangiectasis, atrophy, &c., are also less likely to occur than after the use of the X-rays alone, and seem in some of our cases to have been prevented altogether.

In very extensive cases, especially if there is much fibrosis or massive infiltration, or, again, if the disease is actively spreading, neither Finsen light nor X-rays may prove of avail, on account of the smallness of the area treated by the former and the difficulty of keeping pace with the spread of the disease, and the tendency to the formation of telangiectases, &c., from the prolonged and strong applications of the latter which are required before the granuloma is destroyed.

In these unfavourable cases a preliminary scraping is probably the best course to pursue, or, in spreading and disseminated cases, injections of tuberculin may be tried.

In lupus of the limbs or covered parts, where cosmetic results are immaterial, excision and grafting or scraping are indicated.

For lupus of mucous membranes accessible to X-rays these give good results. In the upper nasal passages the galvano-cautery, lactic acid, and other chemical caustics may be used. But when lupus is situated over joints, and it is important to avoid the production of a contracting scar, we have had good results from X-rays.

CHAPTER VI

TREATMENT OF LUPUS VULGARIS: CASES AND RESULTS

Cases in which light treatment alone was used—Cases in which it was combined with radiotherapy—Summary of authors' results

In the preceding chapter we have discussed the advantages and the disadvantages of the treatment of lupus vulgaris with the Finsen light and with the X-rays respectively. We now give further details of some of our early reported cases, which will serve to illustrate both the advantages and the difficulties of these methods of treatment, the first group consisting of cases in which, with one slight exception, the light treatment alone was employed, the second of cases in which it was combined with X-ray treatment.

Light Treatment of Lupus Vulgaris

I

Man aged 48. (Reported in the *British Medical Journal* of February 9, 1901, as Case ii., and again in the same journal for May 31, 1902.) Nothing of special interest in family history. No history of skin disease or consumption.

Personal history.—Had always been fairly healthy, although very subject to headaches.

The disease was first observed at the age of 10, on the right cheek, when it was about the size of the little finger-nail. It increased in size very slowly for the first few years. In 1889 it was about the size of a small hen's egg in circumference. It was scraped in the summer of that year, and again in 1890. The lupus then began to spread very rapidly, involving nearly all the skin on the right side of the face. It did not appear on the left side of the face until about 1895. In addition to scraping the patient had used pyrogallic acid ointment, and had had it cauterised with the galvano-cautery. In 1899 he was treated twice daily at the Finsen Institute in Copenhagen for three months, both by sunlight and the arc-lamp.

Condition.—When he came under our treatment both sides of the face were extensively affected with a somewhat superficial non-ulcerative lupus; the nose and central part of the face had remained clear. The surface presented a very fine smooth scar tissue, which was deeply pigmented, so that it was difficult to see the individual nodules, which, indeed, were scarce owing to the treatment in Copenhagen. On the left side the disease extended from the level of the outer angle of the orbit, the whole side of the face being involved behind a line drawn from this point to the middle of the ramus of the jaw, and extending posteriorly close up to the line of attachment of the ear. This side was treated principally with the electric light at Copenhagen, and the disease practically disappeared for the time; it, however, relapsed about three months afterwards, and a fresh growth of nodules took place, which were now seen especially at the upper and anterior

margin near the eye, and also at the lower border near the angle of the mouth. On the right side, beginning at the outer angle of the orbit, the anterior boundary extended downwards to a point on the cheek about 1 inch from the ala of the nose; from here it curved downwards and backwards, and then again inwards to reach the chin in the middle line; it then curved backwards on the neck to the ear, the whole of which was involved in the disease, and the skin for 1 inch behind it, until it reached the border of the hair in the temporal region, about ½ an inch above the level of the top of the ear; from this point it formed a slight curve with the convexity upwards, and fell to meet the starting point at the outer angle of the orbit. The right ear was enormously enlarged from lymphatic obstruction; numerous nodules could be seen in the skin.

Treatment.—Treatment was commenced on May 1st, 1900, one hour every day, the left side being treated first. The skin reacted very easily, and the patient made a steady improvement. The skin of the left side of the face, which was treated daily, became smooth and soft, and in the malar region especially it was difficult to make out any nodules. An isolated nodule, situated close to the outer angle of the orbit, completely disappeared as the result of a single application. At the lower margin of the diseased area, near the angle of the mouth, there were still several distinct nodules. Treatment to the right side of the face was begun on June 8th. On June 26th the right side was beginning to show some improvement. The right ear, which had always been much enlarged, was, however, increasing in size.

At the beginning of October the improvement was

very marked. The skin presented a fine, supple, pigmented scar, with a few nodules at the edges and scattered here and there in other parts. On the left side scarcely any disease could be detected, but numerous nodules were still present on the right side of the face, especially under the chin, and on the neck.

The swollen ear was treated again for some days, and became very sore. There was a small brownish-coloured spot on the lobe of the left ear, which had been present about a week, and resembled a lupus nodule, although no "apple jelly" could be seen deep in the skin when it was pressed with a glass.

At the end of May, 1901, when the patient had had 223 applications, he was unable to continue the treatment owing to pressure of work. At this time the skin of the cheeks presented a fine, smooth, pigmented scar tissue with no active disease in the central parts. At the margin of the patch, however, on the cheeks, under the chin, and on the neck, the nodules reappeared as fast as they were treated, and the disease was only just kept in check by the single daily applications. The right ear, which from being enormously œdematous and swollen had become somewhat smaller from treatment, was again increasing in size. At the beginning of November the disease had gone back considerably, although the benefit derived was still very evident. The disease was active at the edges of the diseased area, and there were a few apparently fresh, rather prominent, and infiltrated nodules near the nose, at the inner margin of the patch. In other parts, also, the lupus showed signs of becoming more active. In this month the patient was again treated with X-rays, but at

PLATE IV. CASE OF SCLEROSING LUPUS VULGARIS TREATED WITH LIGHT. (*p.* 69.)

that time it was considered unsafe to expose large areas, and partly on this account and partly on account of frequent cessation of treatment, he had made very little headway when he discontinued attendance in April, 1903.

Remarks.—The treatment, although at first successful, finally failed owing to the large extent and aggressive nature of the disease, and also because the patient was unable to give up sufficient time to it.

II

Woman aged 30 (Plate IV.). (Reported in the *Practitioner* for April, 1903, as Case iv.) Father and mother in good health, also one brother and four sisters. No consumption in the present generation.

Personal history.—The patient had always been "delicate." She had an attack of pleurisy at the age of 27.

The disease began at the age of 10, close to the right ear. The patient first noticed a "lump which burst and formed a sore." She was treated at a hospital with lotions and ointments, but had no operative treatment. The disease had a tendency to heal and became much better.

Condition.—The patient looked weakly and emaciated, and was of a sallow dark complexion. The right cheek and side of the neck were extensively scarred, and the lower part of the ear of the same side had been destroyed. In the scar and at its periphery were red, slightly raised, diseased patches, and discrete brown nodules were sparsely scattered throughout the scar.

The cicatricial tissue was fine, fairly smooth, and comparatively healthy.

Treatment.—This was commenced on September 5th, 1901, the light being applied for one hour daily. There was nothing special to record except gradual and progressive improvement, reaction following each application in the usual way.

At the end of December, after three weeks' interval without treatment, the improvement was very noticeable, but three diseased foci still remained in the form of yellowish infiltrations, two situated near the ear and one on the ear. Otherwise the scar looked pale, smooth, and healthy.

Regular treatment was discontinued on January 22nd, 1902, and there were only two more applications after that date. On April 25th it was noted that the disease had entirely disappeared except for a suspicious spot close to and in front of the ear, and a small lesion on the ear itself. Otherwise the scar was apparently quite healthy, and presented a white smooth surface with one or two pigmented spots here and there.

The patient was discharged on April 28th, 1902, after having had 84 applications. There was no recurrence in February, 1903. The patient has not been seen since that time.

III

Female aged 19. (Reported in the *British Medical Journal* of May 31, 1902, as Case vi.) Family and personal history good. No history of tuberculosis.

History.—When she was seven years of age, after an attack of influenza, a small "red spot" the size of

a pin's head was noticed on the left cheek near the nose. This became slightly raised above the surface and gradually increased in size. When she was ten years of age and the spot was as large as a threepenny-piece, she went to Guy's Hospital, where it was operated on with the cautery. The resulting scar remained healthy for two years, when there was a slight relapse, for which she used an ointment, but the patch gradually increased in size.

Condition.—There was a small, nearly circular patch of lupus, about the size of a sixpenny-piece, situated on the left side of the face near the ala of the nose. It consisted of thick raised lupoid tissue of a brown colour, with a well-defined edge and no satellite nodules.

Treatment.—The Finsen treatment was begun on March 15th, 1901. On March 22nd, after seven applications, there was practically no reaction. On March 26th, after eight applications, the patch was less elevated, and the surface was red and had a macerated appearance. On April 3rd there were considerable redness and discharge, and the part was sore and tender. On April 23rd very little lupus remained, and only a single nodule could be detected. On May 8th a few more exposures were found necessary, as there were still some remnants of the disease.

Treatment was discontinued on May 15th, after twenty-nine applications. On June 1st no relapse had occurred. In August a small pustule appeared in the centre of the scar, but this disappeared after being touched with pure carbolic acid.

When the patient was last seen the original site of the disease could scarcely be detected, the patch of lupus

being replaced by a fine scar which resembled normal skin. The further history of the case is unknown.

IV

Boy aged 12. (Reported in the *British Medical Journal* of May 31st, 1902, as Case v.) Family history good. No report of tuberculosis.

Personal history.—The disease began in 1897, from a "small scratch" on the left side of his face, which did not heal, and was followed by a "small shiny red spot." It was not treated for two years, when it was cauterised once or twice a week for about three months. After this the disease was excised five times in succession, but it recurred very soon after each operation. The last excision was performed early in 1902, and two small brown spots made their appearance almost directly after the wound had healed.

Condition.—When the patient came under observation there was a linear scar about $\frac{3}{4}$ in. long, situated on the left cheek midway between the angle of the jaw and the corner of the mouth. At the upper end of the scar there were two small nodules of lupus embedded in the scar tissue. The remainder of the scar appeared to be healthy.

Treatment.—Finsen light treatment was begun on October 26th, 1900. On the following day two small blebs appeared. These coalesced to form a large bleb, which concealed the underlying lupus. After a week's treatment, on removal of the crust a pit was seen in the situation previously occupied by one of the nodules; the other could not be detected. On December 12th

PLATE V. CASE OF NON-ULCERATIVE LUPUS VULGARIS TREATED WITH LIGHT. (*p.* 73.)

the nodules were apparently more superficial, and another not previously visible had appeared. The two deep-seated nodules at the upper part of the scar had coalesced to form a pale superficial infiltration with indefinite outlines. The scar was flatter and softer. On January 9th, 1901, two faintly discoloured spots could be made out on pressure of the glass; with ordinary observation no disease was visible. Three more consecutive applications were given, making eleven altogether. Treatment was discontinued on January 11th.

When seen on May 7th, 1902, there was no recurrence. The further history of the case is unknown.

V

Girl aged 13 (Plate V.). (Reported in the *Practitioner* for April, 1903, as Case ii.) Father and mother healthy. Seven brothers and sisters also in good health. No consumption in the family.

Personal history.—The patient had had measles and whooping-cough, otherwise her general health had been very good.

When she was seven years of age a small scaly patch "like eczema" was noticed under her chin. This gradually increased in size, but no particular notice was taken of it until 1902, when the diagnosis of lupus was made. Beyond the use of ointments, no treatment was adopted before the light applications were commenced.

Condition.—There was a small patch of typical lupus situated under the chin in the central line of the neck. It measured 2½ in. by 2 in., and was circular in shape,

with an irregular margin. It consisted of large brown foci of lupus separated by small streaks of healthy skin. There was also a small patch on the right buttock.

Treatment.—The patient was treated with forty-nine applications of Finsen light, and nine with Marshall and Wood's lamp. On December 23rd, 1902, three months after treatment was stopped, a smooth pale area of skin, scarcely recognisable as scar tissue, remained, and no disease could be detected. She has been seen several times since, and there has been no relapse up to the present year (1907). The patch on the buttock was removed with pyrogallic acid ointment and acid nitrate of mercury.

VI

Woman aged 25 (Plate VI.). (Reported in full in the *Practitioner* for April, 1903, as Case i.)

History.—There was nothing of medical interest in her family or antecedent personal history. When she was three years of age she received an injury causing a slight wound which was slow in healing, and from which the lupus developed. The patch was about the size of a sixpenny-piece, and gradually enlarged.

Condition.—At the commencement of treatment on January 2nd, 1901, there was a circular brown patch of lupus on the tip of the chin a little to the left of the middle line. It measured 1½ in. each way. The patch was infiltrated with the granuloma throughout its whole extent, and there were no discrete nodules nor areas of healthy skin.

Treatment.—The patient was treated with Finsen light from January 2nd to March 30th, 1901, and had 61 applications altogether.

CASE OF NON-ULCERATIVE LUPUS VULGARIS TREATED WITH LIGHT.

PLATE VI. *(p. 74.)*

There was no recurrence of the lupus five years afterwards, but in March, 1906, a pin-point nodule was noticed in the scar, which was otherwise healthy. Five more applications of Finsen light were given from March 26th to April 3rd, 1906, and the patient has not been seen since the last date.

Remarks.—This case had not been treated by any other method, and presented conditions favourable to the light method. The result was as nearly as possible perfect. No visible scar remained, and the area previously occupied by the disease could scarcely be distinguished from normal skin. But the case is important in showing how long the disease may remain latent before relapse occurs.

Treatment with Light and X-rays Combined

I

Married woman aged 32. (Reported in the *British Medical Journal* of May 31st, 1902, as Case vii.)

History.—Family and personal general history good. No report of tuberculosis.

The lupus began on her left cheek when she was 16 years of age; she remembered it first as a small red patch, which gradually increased in size. In the following year it was scraped. Eight years afterwards it was again scraped and cauterised. In spite of these operations, the disease was never completely eradicated, and after the last scraping became more active.

Condition.—There was a triangular patch of lupus on the left cheek, the base of the triangle being uppermost and represented by a line drawn from the lobe of

the ear to the lowest point of the ala of the nose. From this base line the patch gradually tapered almost to a point, terminating at the lower edge of the jaw. The patch measured about 1½ in. either way. The surface was scaly, dark brown in colour, and slightly raised. The infiltration was confluent except at the upper edge, where there were some discrete nodules. There was no visible scarring, but the characters of the disease were partly obscured by large scales.

Treatment.—Finsen light treatment for one hour daily was begun on March 26th, 1901. Sharp reactions followed each exposure, and on May 9th the whole of the diseased area was inflamed and discharging, so that the granulomatous tissue was hidden. On June 15th marked improvement was noted, most of the infiltration having disappeared. On September 10th, after a month's interval without treatment, the improvement was still further manifest. In October daily applications were stopped, but occasional treatment was necessary owing to the fact that one or two nodules persistently cropped up after the treatment had been stopped for any considerable period. On January 14th, 1902, there was practically no disease in the scar, but occasional courses of treatment were found necessary for recurring nodules during 1902 and 1903. In 1904 about 30 applications were given. At the end of 1905 19 exposures of X-rays were given in the hope that they might prevent the nodules from recurring. In 1907, after a year without treatment, the patient returned with three or four large raised infiltrations in the scar, which necessitated further treatment with Finsen light, and she is still under treatment.

CASE OF DEEPLY INFILTRATED LUPUS VULGARIS TREATED WITH LIGHT AND X-RAYS.

PLATE VII. (*p.* 77.)

Remarks.—The initial successful result in this case was unfortunately not maintained. Apparently owing to the thickness of the scar making total extirpation of the deep-seated lupus almost impossible, nodules persistently reappeared soon after treatment was stopped.

II

Girl aged 13 (Plate VII.). (Reported in the *Practitioner* for April, 1903, as Case iii.) Father and mother and three brothers healthy.

Personal history.—Apart from her skin disease, the patient had always been in good health.

The disease was first noticed on the hand, when she was seven years of age. She did not remember when it first appeared on the face, but thought it was about the size of a sixpenny-piece when she was 10 years old. It had been spreading rapidly of late, and in 1901 was "twice as large as it was last year." The patch on the hand had not increased in size for some time. The disease had been scraped 18 times, at intervals of about a month, the hand being scraped at the same time as the face. It was also "burnt" at a London hospital in 1898.

Condition.—There was a large patch of thick nodular lupus occupying the greater part of the left side of the face. Above, it extended from the external canthus to the lobe of the ear; behind, to the line of insertion of the ear; and below, to the angle of the jaw, from which point the margin curved round on to the cheek, passing the angle of the mouth to reach a point about 1 in. from the ala of the nose. From this

point the upper limit passed backwards to the ear. There was also a patch of lupus on the dorsum of the right hand, involving the cleft between the index and middle fingers and extending posteriorly to the base of the metacarpal bone of the index finger. It was about $2\frac{1}{2}$ in. long and $1\frac{1}{4}$ in. wide. The patch was thick, warty, and fissured.

Treatment.—This was begun on April 15th, 1901, with one and sometimes two hours' daily application of the Finsen light. On May 10th the patient contracted diphtheria, and the treatment was interrupted. She returned on June 28th, and from that date until January, 1903, had almost continuous daily treatment.

Improvement was very slow, and pyrogallic acid ointment was used frequently to reduce the great thickness of the lupoid infiltration. The patch on the hand was treated with X-rays, but showed little improvement either with these or with the Finsen light. The application of a pyrogallic and salicylic acid ointment gave better results, but the patch still maintained a tendency to spread at the edges.

In January, 1903, the London Hospital modification of the Lortet-Genoud lamp was tried, but this seemed to produce little effect, and in August of the same year the large Finsen lamp was reverted to.

In 1904 the Finsen treatment was continued three times weekly.

In January, 1905, the central part of the scar remained pale and free from lupus, but much infiltration persisted at the periphery, and it was thought advisable to try to remove it with X-rays. This treatment was continued until the end of August, 1905, when there

PLATE VIII. CASE OF HYPERTROPHIC LUPUS VULGARIS TREATED WITH LIGHT AND X-RAYS. *(p. 79.)*

was an interval of three months without treatment. The X-rays were again applied and continued until December, 1905, when the patient resumed treatment at the Middlesex Hospital. Here, on account of the telangiectasis which had formed as a result of the X-rays, she was treated, at the suggestion of Mr. Lyster, with a high-frequency vacuum electrode, giving off X-rays, and also with the London Hospital lamp, the healthy parts of the scar being avoided.

When she was last seen, in March, 1907, the central part of the scar had remained healthy, although somewhat disfigured by telangiectasis, but there was lupus still present at the periphery, although there had been no extension of the disease.

III

Single woman aged 36 (Plate VIII.). (Reported in the *Practitioner* for April, 1903, as Case vi.) Nothing of special medical interest in family history; no known consumption in the family.

Personal history.—The patient's general health had been fairly good, but she had always been "delicate and nervous."

The lupus was first noticed as a small spot on the left side of the lip, when she was 30 years of age. It was left without treatment for 18 months. Two years afterwards it is said to have made its appearance on the nose, at first inside and then outside. She had "homœopathic treatment," and after this the diseased part was "punctured" under an anæsthetic. Improvement resulted for a time, and no further treatment was adopted for a year. The diseased area was then

scraped at a London hospital, but the improvement was only temporary. Cauterisation was next tried, but without success, the lupus spreading rapidly and affecting the right cheek as well as the nose. Soon after this the left side of the face became involved.

Condition.—The disease affected nearly the whole of the skin of the nose except a small portion at the upper part on the left side. On the right cheek, just below the eye, there was a patch about the size of a half-crown, reaching outwardly as far as the line of the outer canthus and sending a process up to the inner canthus. This patch was continuous with the disease on the nose. On the left cheek there was a small raised scaly patch, and there was another small patch on the left side of the upper lip. In parts, especially on the left cheek near the nose, there was some scar tissue. The mucous membrane of the nose was only slightly affected and gave no trouble. The lesions were not ulcerated, but were raised and nodular and covered with scales. The main patch on the nose was composed of a continuous sheet of lupus without any intervening healthy skin.

Treatment.—Light treatment was begun on February 27th, 1901. There were good reactions, and there was steady improvement. By the end of April considerable progress had been made, and on May 29th the diseased surfaces were much flatter and less hypertrophic. At the beginning of September, after a rest of three weeks, the skin on the left cheek and on the nose was pale, smooth and soft, and to all appearance normal. A few nodules could, however, be seen in the scar on pressure with a glass. The original scar tissue was also softer. On the right cheek, where the

CASE OF EXTENSIVE NODULAR AND ULCERATIVE LUPUS VULGARIS TREATED WITH LIGHT AND X-RAYS.
PLATE IX.

(*p. 81.*)

disease was more active, a little redness of the skin remained, but here also the improvement was very marked. In January, 1903, a lupous nodule could be detected here and there in a smooth but slightly reddened scar. On March 14th, 1903, no definite nodules could be seen, but it was thought advisable to make a few further applications to one or two suspicious spots.

In 1903 and 1904 occasional short courses of treatment were required for relapsing nodules. In 1905 the patient had no treatment, but in 1906 there was again a slight recurrence in the scar, for which she was treated with the high-frequency current and X-rays.

IV

Woman aged 34 (Plate IX.). (Reported in the *British Medical Journal* of February 9th, 1901, and again in the same journal of May 31st, 1902.)

History.—There was nothing of medical interest in the patient's family or personal antecedents. The case was one of severe extensive nodular lupus vulgaris affecting both sides of the face, as shown in Plate IX., and first manifesting itself when she was 16. There were also a few foci on the body. She had undergone almost every known form of treatment, including scraping—34 times—and courses of injections of tuberculin (Nos. 1 and 2), besides injections of yeast.

Treatment.—Finsen treatment was commenced on May 16th, 1900 (a small area which had previously been treated with X-rays being excluded). The initial improvement was very rapid, and by the end of July the raised nodules on the right side of the face had been

reduced to the level of the normal skin, leaving pale smooth pigmented areas. The application of X-rays to the skin of part of the upper lip and an adjacent area surrounding the angle of the mouth had also been continued, and the skin now presented a pink shiny surface almost devoid of nodules. At the beginning of August the diseased surfaces on the right cheek had been gone over several times with the light, and a smooth pale surface without any elevated nodules resulted. At the same time it was noted that a few nodules had reappeared on the lower border of the patch on the right cheek, which had not been treated for some time. By the middle of November the affected skin was everywhere smooth and supple, with no scar in the accepted sense of the term. At the end of December the whole of the diseased surface was pale and without thickening. There was a good deal of pigmentation, which obscured the nodules, but, as far as could be seen, these were few in number and quite superficial.

For the next six months daily Finsen treatment was continued, and steady progress was made. Occasional applications of X-rays were also given to the area which had been treated by this method from the first. Eight applications of ten minutes each usually sufficed to produce a reaction.

After an interval of a few weeks in July, there was a slight relapse on the left side of the upper lip and on the left cheek—the areas treated with X-rays. The scar in this part was somewhat tense and hard, contrasting with the smooth, supple scar resulting from the Finsen applications.

By the end of September very little lupus remained,

Some recurrent nodules in the X-ray areas were given a few applications of Finsen light, and it was noticed that the reactions were more severe than in the parts not previously X-rayed. In October regular daily treatment was stopped, and the patient only came occasionally, when any nodules reappeared.

In January, 1902, there was another relapse in the "X-ray part" after a short interval without treatment, and a few more applications of the Finsen light again resulted in severe reactions which did not heal for several weeks. It was therefore thought better to continue the X-rays on this part. The scar on the right side of the cheek remained sound; there was some increased growth of hair on the right cheek.

In September there were a few superficial nodules which had appeared during an interval without treatment, the part which had been treated with X-rays showing the greatest tendency to relapse.

In January, 1903, the left half of the upper lip and the area of skin adjacent to it were still infiltrated with lupus in spite of continuous exposures of X-rays and repeated slight dermatitis.

An isolated spot of lupus was given a single application with the Marshall and Woods lamp; the reaction was slight, but was followed by a circular patch of pigmentation which remained for six weeks. The rest of the face was practically free from disease, and the cheeks, although pigmented, were smooth like the normal skin.

From this time Finsen treatment was practically discontinued, although the patient had a few applications in February, July, and October, 1903.

On March 24th, 1904, she returned with a few fresh nodules, but it was decided to postpone treatment on account of her having become pregnant. She had had no Finsen treatment since the end of October, 1903, but had short courses of X-rays up to January 27th, 1904.

She was not seen again until October 21st, 1904, after she had given birth to a healthy child. With the exception of one or two minute nodules here and there, the parts treated with Finsen light remained healthy, although she had had no applications for a year. On the other hand, the "X-ray part" was still affected, the left half of the upper lip being again diffusely infiltrated with lupus. Ten exposures of X-rays were given to this area from October 24th to November 5th, 1904, and the patient has not been seen since this date.

Remarks.—This case illustrates the facts that Finsen light gives much better cosmetic results than X-rays, is more efficacious in getting rid of the disease, and is less apt to be followed by relapses. In spite of repeated X-ray reaction the lupus was not eradicated, and the resulting scar became disfigured by telangiectasis. The part treated with Finsen light, although this was commenced later and discontinued earlier than the X-rays, has remained well for three years, whereas the X-ray part is still markedly affected.

V

Man aged 22. (Reported in the *British Medical Journal*, February 9th, 1901, as Case iii., and continued in that journal of May 31st, 1902.)

History.—Family and personal history good. No history of tuberculosis.

The disease began when the patient was seven or eight years of age, on the left side of the nose. From this place it spread for about a month, when he went to a hospital and had it treated with an ointment, but had no active treatment until 1890, when it was cauterised with nitric acid twice a week for six months. In 1891 he had a course of Koch's tuberculin (No. 1). This was continued for about a year with intervals of rest, but there was not much improvement. The disease began to spread again in a short time, when he went to another hospital, and there it was scraped three times and a piece was excised from the right angle of the mouth. In 1896 he was treated at St. Mary's Hospital with thyroid extract, from which he derived some benefit. In April, 1897, he had a course of Koch's second tuberculin, under which the lupus steadily improved and most of the ulceration healed.

Condition.—The lupus affected the central part of the face, being roughly enclosed in a circle of about $3\frac{1}{2}$ in. in diameter. The cartilaginous part of the nose was destroyed and part of the septum projected, and there was some obstruction of both the nostrils. Both lips were extensively ulcerated, and presented a raw irregular surface partly covered by crusts. The upper lip was swollen and protruded from œdema; the lower lip was comparatively healthy, but there was ulceration at both angles of the mouth, extending into the buccal cavity; the skin below the red margin of the lower lip was also ulcerated. On the cheeks there was no ulceration, the skin being smooth and red and

studded with nodules of lupus. The upper lip and the chin were deeply scarred, and there was a linear scar along each naso-labial fold. On the right side of the chin below the main patch there were numerous outlying nodules. The lips could not be fully everted, but the gums were apparently not affected. The teeth were very bad, and evidently aggravated the ulceration of the adjacent mucous membranes.

Treatment.—Finsen treatment was begun on June 20th, 1900, for one hour daily. The ulcerating surfaces of the upper and lower lips were at first treated with boric compresses after the applications of light. On July 10th the ulcerated surfaces were cleaner and the parts treated were reacting sharply. On September 25th, after an interval of rest, there was decided improvement, but the ulceration at the corners of the mouth, which had nearly healed, had broken down again.

By December 1st, although treatment had only been carried on intermittently on account of the severity of the reactions, the improvement was very marked, especially in the upper lip, and the nodules on the cheeks had almost disappeared. On January 3rd, 1901, there were still a few nodules in the scar, especially at the edges of the patch on the cheeks. The ulcerations on the mouth were smaller and shallower, but did not heal completely, and soon became worse if treatment was discontinued.

On May 7th the light treatment was stopped and X-rays were resorted to. Eight exposures to each corner of the mouth were sufficient to set up reaction, and when the inflammation subsided the ulcerations very rapidly healed. By the time the patient had had twenty applications all the ulcers were healed and the swelling of

the upper lip was much reduced. The ulcers showed no tendency to break down, and had remained sound for more than a year afterwards. A relapse occurred on the cheeks, however, after treatment had been stopped for eight months. The nodules in the scar at the periphery of the patch again became large and prominent, and a few fresh ones formed. The patient was then treated with X-rays at varying intervals for six months, at the end of which time the nodules had again almost disappeared.

We have no further record of the patient's condition.

Remarks.—This case illustrates the beneficial effects of X-rays in severe ulcerating lupus with œdema of the nose and lips which was only slightly benefited by the Finsen rays. On the other hand, the discrete nodules on the skin of the face were more favourably affected by the Finsen light.

Summary of authors' results.—As every case of lupus differs according to the extent, depth, position, and type of lesion, as well as variation of soil, any classification is more or less unsatisfactory. Statistics are apt to be misleading on account of the difficulty of knowing when the disease has been permanently removed. For purposes of description we have divided our cases into those of small, moderate, and large extent, although these groups do not necessarily indicate corresponding degrees of amenability to treatment.

Of 26 cases of *small extent* practically all were temporarily cured, but in most of them slight relapses occurred. In two cases small nodules reappeared after the patches had remained well for six years. In two

or three others small patches on the tip of the nose have remained well for a similar period, but relapse occurred in the mucous membrane. Several cases have not been under observation sufficiently long for any definite statements as regards cure to be made, and some, again, have not been seen since they were discharged as cured.

Of 38 cases of *moderate extent* all improved under treatment, and many of them have remained free from disease for long periods, but in nearly all slight relapses have occurred necessitating short courses of treatment from time to time. In other words, they have been kept well, although not cured in the strict sense of the term. In one or two cases neither Finsen light, X-rays, nor radium prevented relapses occurring within a short time of the cessation of treatment.

In 20 cases of *large extent* nine have been brought into a condition in which only occasional treatment has been required at long intervals, and the disease has been symptomatically cured.

In three cases in which the lupus was of great depth, forming a dense confluent mass, protracted treatment produced some diminution of the infiltration, but failed to remove it, and in three others the lupus was so active that it was impossible to keep pace with the spread of the disease. Two patients died, one from the result of an epithelioma developing on a lupus patch. The remaining cases improved under treatment, but have not been seen since.

CHAPTER VII

TREATMENT OF LUPUS ERYTHEMATOSUS

X-ray treatment—Treatment with light and high-frequency currents—Authors' case treated with light and high-frequency —Another treated with light alone

X-ray treatment.—According to Allen, this disease has shown a disposition to yield to the rays more readily than to any other method, with the possible exception of the high-frequency currents. The sebaceous form, he considers, shows the greatest reaction under the influence of raying, about 90 per cent. of cases being cured in from 18 to 35 sittings. The erythematous form does not give such prompt or such certain results, and treatment must be largely combined with other measures. Out of 16 cases treated by him, 2 have been entirely cured, 2 seemingly cured had recurrence, and 12 were very much benefited.

Sjögren treated 6 cases, of which 5 were cured, all, however, requiring repeated periods of treatment on account of recurrences.

Favourable results have been reported by Schiff and Freund, Jutassy, Scholtz, Ullmann, Woods, Lee, Oudin, and other authors. Taylor, Hahn, Neumann, and Grouven report good results, but repeated treatment was required on account of frequent relapses.

Kienböck advocates large doses, and Belot agrees with him. According to Belot, the X-rays do not seem to give better results than other methods, the more inveterate varieties not improving without violent reaction, and even then the improvement not always being permanent.

On the whole, the results of the X-rays in this disease appear to be uncertain, and can scarcely be considered an advance on the older methods. As the result either of repeated small doses of X-rays or of massive doses causing violent reaction, temporary cures have occurred. On the other hand, fractional doses may fail, or may aggravate the disease, and large doses, causing various degrees of dermatitis and subsequent cutaneous atrophy, are scarcely to be recommended. Owing to the tendency of the rays to cause vascular dilatation and telangiectasis—conditions which are often associated with lupus erythematosus—we have doubted their suitability and have preferred other measures. They may be useful in the follicular or sebaceous types, but we have tried them in only a few cases. Although improvement, and often arrest of the morbid process, may be expected in the majority of cases, we have found it very difficult to obtain complete removal of the disease, and relapses are common.

Light treatment.—In the Paris Congress (July, 1900), Forchhammer reported on 38 cases treated by Finsen; 12 were cured, 13 were being treated, and 13 had ceased treatment.

Leredde and Pautrier treated 23 cases, 11 of which were entirely cured and 3 were improved; in 6, isolated patches were cured, and in 3 there was complete failure.

Favourable results have also been obtained by Gastou, Baudouin, and Chatin (10 cases, with 3 complete and 7 partial recoveries), and by Helm, Veljaminoff, and Sjögren. Sequeira treated 14 cases, with successful results in 7.

Treatment with light and high-frequency currents.—Of physical methods of treatment we have obtained the best results with high-frequency currents and Finsen treatment, the latter in chronic and the former in the subacute cases. Of 15 of our cases treated by the Finsen light, 13 were greatly improved, and of these several were temporarily cured, while 2 showed no improvement. Five other cases showed decided improvement under high-frequency treatment.

Two cases.—In a case of ours reported in the *British Medical Journal* of February 9th, 1901 (Mrs. X., aged 45), and continued in the number for May 31st, 1902, light treatment was combined with high-frequency currents.

History.—Family and general personal history good. No history of tuberculosis.

The patient's complaint was noticed about 15 years previously, and began in the neighbourhood of the left eye. Two or three years later the lower lip became affected, and then the upper lip and right orbital region. Various kinds of treatment were tried, including scraping, "electric needling," burning with the cautery and oxygen, while potassium iodide and other drugs were taken internally.

Condition.—When light treatment was begun the face was affected with symmetrical patches of lupus erythematosus. There were two patches below the lower

lip extending for about an inch below the red margin on either side of the middle line. The upper lip was also involved from the nose to the angles of the mouth on either side. There were also two symmetrical patches in the infraorbital regions extending about an inch below the lower eyelids, and causing slight ectropion.

Treatment.—Finsen light treatment was commenced on May 31st, 1900. After the first application of one hour to an area on the left side of the chin there was severe reaction with pain and swelling of the face. When this subsided, a small white scar was left in the middle of the erythematous area where the compressor had been applied.

On account of the severity of the first reaction, short applications of 15 minutes to half an hour were given. Each was followed by reaction, the severity of which depended upon the length of exposure. The applications were continued at considerable intervals until September 13th. The erythematous area became paler, and in parts the patches were replaced by smooth white atrophic skin.

On October 5th, after an interval without treatment, there was marked improvement; all the patches were less hyperæmic, and the one below the left eye had almost disappeared, leaving a smooth white surface.

On November 8th, after a month's interval, the patch below the left eye was scarcely visible. The patches below the left eye and on the upper lip were all much improved, but on the chin the lesions were about the same as at first.

On December 3rd, after the patient had had 27 ap-

plications in all, the improvement had continued, and there was no relapse of the parts that had healed, but, owing to long intervals between the applications, several patches remained unhealed. Treatment was discontinued after she had had about 100 exposures.

In March, 1904, after two years without treatment, several of the patches had relapsed. Applications of the high-frequency current were then tried, but she was unable to give up sufficient time to the treatment, and stopped coming after she had had seven applications.

Remarks.—This case illustrates the power of Finsen light applications to set up severe reaction in acute lupus erythematosus (in chronic cases our experience has been that reaction occurs less readily than in lupus vulgaris), and shows that this may be followed by resolution of the disease, although no immunity is conferred against relapse. In the present instance, however, the treatment was too intermittent to afford a fair test of the value of the method.

In the other case the light treatment alone was employed. The patient was 50 years of age, and the lupus erythematosus is said to have begun suddenly 18 months before, as a small pimple on the right side of the nose near the inner angle of the eye. It gradually increased in size, and was scraped four times in June, August, October, and November, 1906. After each scraping the wound healed, but the disease was not eradicated. She came under our care on February 26th, 1907, and at this time there was a small red patch at the upper part of the nose about an inch either way, extending to the inner canthus on the right side. The

centre was scarred, the edges were raised and thickened. She rapidly improved under the Finsen light, the patch becoming paler and the thickening disappearing from the edge. She had three applications a week, and after 17 the patch had practically disappeared. After 34 applications there was a good deal of inflammatory reaction, and Finsen treatment was discontinued on May 17th, 1907.

CHAPTER VIII

TREATMENT OF RODENT ULCER

Sequeira's results—Microscopical changes under X-rays—Efficacy of radiotherapy in rodent ulcer—Selection of method—Cases treated by X-rays, by light, by light and X-rays, and by light, X-rays, radium, and operation—Summary of authors' results

Rodent ulcer, which in its clinical course and appearance, its freedom from metastasis, and its microscopical anatomy, is distinct from ordinary squamous epithelioma, is included by many foreign authors with that disease, and the results of the treatment of the two conditions are apt to be confused. Sequeira published his results of the treatment of 12 cases of rodent ulcer by X-rays in 1901. At the Oxford meeting of the British Medical Association (1904) he reported 128 cases treated at the London Hospital. "Of these 4 proved intractable and in 2 an epithelioma developed. Of 80 completed cases 30 required more than one course of treatment, that is, in about 33 per cent. cases apparently cured had relapsed, but in all of them the relapses were easily removed. In one case where the X-rays failed, radium was successful. In another, which was still under treatment, no improvement was manifest under the X-rays, but radium seemed likely to effect a cure."

Microscopical changes in rodent ulcer.—Sequeira observed certain changes under the X-rays in the nuclei and protoplasm of the cells of the rodent growth in all the cases examined by him. He writes: "The nuclei become disorganised, and the cell plasm breaks up, often becoming fatty. At the same time there is an infiltration of leucocytes, and it is impossible to determine whether the damage done to the epithelial cells is the direct effect of the rays, owing to the 'bombardment of the cells,' or whether the effect is indirect and due to the leucocytic infiltration or to obscure nervous and vascular changes. While the destruction of the epithelial cells is going on there is a marked activity of the connective-tissue elements. There is an infiltration of round cells, of mononuclear cells, and later on a formation of scar tissue. This remarkable activity of the connective tissue is well seen in the rapid filling up of cavities left by the rodent ulceration."

Efficacy of X-ray treatment.—The efficacy of radiotherapy in rodent ulcer is now established beyond doubt, and a large number of successful results are recorded, although a word of caution must be added against taking too optimistic a view of the final results in advanced cases. For purposes of description rodent ulcer may be classified in three groups—non-ulcerative, ulcerative, and deep ulcerative with involvement of periosteum or bone. The small non-ulcerative cases are the most favourable, but even in these relapse after X-ray treatment is not infrequent. The hard raised edge is often refractory, and we have found a few preliminary applications of Finsen light useful in softening

this edge before beginning the X-ray treatment. Others prefer the galvano-cautery or scarification (Sequeira), or they seek to break down the edge by setting up a smart X-ray reaction. Extensive ulcers give relatively better results owing to the rapidity with which they heal under X-rays; and in some of our cases, where destruction has been rapid and the edge is not raised and hard, large cavities have healed and no trace of disease has been left. On the other hand, some of the infiltrating growth remains at the edge in the majority of large ulcers, and even strong applications of the rays may fail to remove it. The same may be said when underlying bone or periosteum is invaded: in several of our cases, in spite of remarkable initial success in the removal of diseased tissue and healing of large cavities, one or more foci of disease affecting the bone have resisted the X-rays, and the final result has been disappointing. Sometimes the skin of the patient becomes so sensitive that sufficiently strong doses of the rays cannot be given, and it is impossible to stay the progress of the disease. In one patient under our care, after almost all traces of the disease had apparently disappeared, the eye became so painful that it had to be removed, and although the whole orbit was cleared out, a spreading focus of disease remained in the bone, and the patient still requires treatment from time to time.

Selection of method.—In small non-ulcerative cases there is a choice between excision—if the disease is in a situation allowing a sufficient margin of healthy tissue to be removed—Finsen or X-rays, separately or combined, and radium. In the ulcerative stage X-rays usually give the best results.

In deep ulcerations with involvement of periosteum or bone, where surgery is impossible, the X-rays or radium give the only chance of arresting or removing the growth.

Caustics (lactic acid, arsenical paste, &c.) are recommended by some writers, but in our experience these are of little use and may aggravate the disease. Lewis Jones has had good results in rodent ulcer from the electrolytic or zinc ion method introduced by Le Duc.

Treatment with X-rays

I

In a case of small rodent of the cheek the patient, aged 45, had a characteristic lesion with a hard raised edge surrounding a circular superficial ulcer about the size of a sixpence, situated in the malar region, which had been noticed for about six months. There were some stiff hairs protruding from the margin of the growth. X-ray treatment was begun on November 16th, 1903. After 17 exposures the ulcer healed and the induration disappeared, leaving a smooth pigmented surface. On July 12th, 1904, there was a slight relapse, and a small crust had formed. The X-rays were resumed, the time of exposure being extended from 10 to 15 minutes and the distance of the anode from the skin decreased by about an inch. After nine exposures the crust became detached, but a little thickening remained; the applications were continued at intervals of two or three days. On August 10th, after 16 exposures, a slight erythema developed, corresponding in size and shape to the aperture in the lead mask used to protect the healthy skin. The

reaction lasted about 10 days, and the skin did not break down. After the inflammation had subsided a flat, smooth, white scar with a little surrounding pigmentation remained, the hairs had come out, and the area was quite soft, all traces of disease having disappeared. When the patient was seen a year later there was no recurrence.

II

In another case the patient had a small typical rodent ulcer of about 15 months' duration, $\frac{3}{4}$ in. in diameter, situated in the centre of the right cheek. The lesion had a raised, pearly, indurated edge, and was ulcerated in the centre. It was treated with X-rays, beginning on October 31st, 1903, with exposures of 10 or 12 minutes, 4 in. to 5 in. from the anode, with three ampères in the primary. After 19 exposures on alternate days, ending December 11th, 1903, nothing remained but a smooth scar with no perceptible induration. On March 23rd, 1904, there was a minute recurrence the size of a pin's head at the upper border of the scar. This was removed after seven exposures of 11 to 14 minutes. On April 12th there was another minute recurrence at the outer border of the scar, and seven more applications of 14 and 15 minutes were given. As far as is known, there has been no recurrence since May, 1904.

Light Treatment

Mrs. B., aged 35. (Reported in the *British Medical Journal* of February 9th, 1901, and of May 31st, 1902.)

History.—Family and personal history good. Nine years before she had noticed a small "speck" on her

right cheek below the eye. It resembled a "chicken-pock" scar, the skin being indented but not thickened. The lesion had remained in a stationary condition for six years, and then she noticed a little scaling and redness of the spot, "like eczema." About four and a half years later (18 months before she was seen by us) the redness and scaling became more pronounced, and a ridge formed round the edge. For some time previously a "head" had continually formed and come off, and slight bleeding occurred when she removed the scab.

Condition.—There was a depressed, thickened, slightly discoloured plaque about 1 in. long and ½ an in. wide, situated just below the right infraorbital ridge. This was surrounded by the typical raised, rolled, pearly edge of a rodent. At the upper margin there was a little commencing ulceration. It was also noticed that there was a small round, depressed scar about the size of a pea above the left eye, said to be similar to that from which the existing lesion originated. It appeared before the latter, but had remained innocent.

Treatment.—Daily applications of Finsen light were begun on June 1st, 1900. After the third sitting there were some reactive redness and swelling and a little throbbing in the part, but no pain or tenderness. On June 11th the ulcerating surface was larger and the discharge had increased, but the patient was easily able to bear the pressure of the glass. On June 13th the lesion presented the appearance of a clean punched-out ulcer, and the indurated edge was becoming included in the ulceration. On June 16th the ulcer was a little larger on account of the absorption of the infiltrating edge.

No induration could now be detected, and treatment

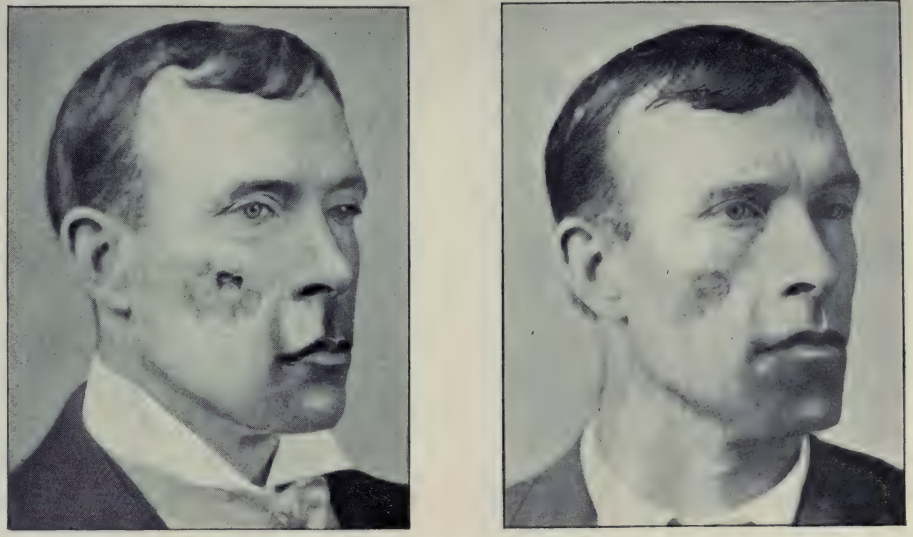


PLATE X. CASE OF RODENT ULCER TREATED WITH LIGHT AND X-RAYS. (*p. 101.*)

was discontinued and the ulcer allowed to heal after 12 applications extending over 16 days. On June 30th the ulcer had nearly healed, the outer edge was rounded, and a little prominent line was apparently formed of healthy scar tissue.

On December 1st the part had remained healthy, and presented a firm, smooth scar. There was a little depression at the upper and outer margin, caused by contraction of the scar, but there was no sign of recurrence of the growth.

The patient returned a year later (December 10th, 1901) with two recurrent nodules. One was a raised, warty-looking growth, the size of a pea, at the upper and outer edge of the scar; the other a linear, slightly raised, semi-translucent infiltration corresponding to the inner margin of the scar. Light treatment was resumed on January 13th, and continued to March 26th, 1902.

The area broke down, as before, to form an ulcer; but, in spite of repeated applications, the infiltration repeatedly returned after these ceased, and the treatment was discontinued before the disease had been eradicated.

Remarks.—The initial improvement in this case was not maintained, and, apparently owing to the survival of a deep-seated focus of disease, relapse repeatedly occurred.

Treatment with Light and X-rays

I

Man aged 45 (Plate X.). (Reported in the *British Medical Journal* of February 9th, 1901, as Case i., Mr. A., and continued in that journal of May 31st, 1902.)

History.—Family and personal general history good.

Three years before he was seen by us the patient had noticed a small spot about the size of a pin's head on his right cheek. He irritated it by shaving and by picking off the scab which constantly formed. By degrees the spot increased in size, and a year after its appearance it was covered with a large scab, after being treated with oleate of mercury ointment. It gave rise to slight irritation and sometimes to a shooting sensation.

Condition.—There was a small circular ulcer, in the right malar region, about the size of a sixpenny-piece and surrounded by a rolled "cartilaginous" edge. The ulcer alternately discharged and scabbed over, and on one or two occasions the skin healed over it.

Treatment.—The Finsen light was first used on June 26th, 1900. The edge was gradually softened, and the base became covered with healthy granulations. On July 6th, after seven applications of one hour's duration, the appearance was that of a simple healing ulcer, and, the edge being soft, treatment was discontinued. On July 20th the ulcer had completely healed, the surface being smooth and the edge soft with the exception of a minute, slightly hard point, apparently consisting of scar tissue, which the patient said was due to a razor-cut, and had been the starting-point of the growth. On December 1st there was no sign of recurrence, and the scar, although a little uneven, was apparently healthy.

A year later, on September 11th, 1901, the patient returned with a slight recurrence at the upper and inner margin of the scar, where there was a small raised nodule as large as a pea, with a hard rounded edge and a flat surface with a slight central depression. It had formed

at the site of the original trouble, in the small scar resulting from a razor-cut. The remainder of the scar was healthy. He had noticed that the lesion had been increasing in size for several months.

X-ray treatment was recommended, and was commenced on September 11th with daily applications of 12 minutes with a primary current of four ampères at a distance of 6 in. from the anticathode, the tube giving a spark of about 8 in. by 10 in. After the fourth exposure (September 16th) there was slight flattening of the growth and some diminution of the induration. After the sixth exposure the infiltration had practically disappeared, and the crust became detached, leaving a glazed, slightly red surface. On September 20th another small crust had formed, which remained until treatment was stopped on September 3rd, after the patient had had 10 applications. On September 27th the crust was easily detached, revealing a smooth red surface with no surrounding or underlying infiltration. The patient has not been seen since that date.

Remarks.—This and the preceding case showed that although the Finsen light was successful in removing the hard edge and the more superficial part of the lesions, it failed in deep-seated infiltrations from which recurrence apparently originated. It was subsequently found that X-rays were more effective where ulceration was present, but that the edge was more easily removed by Finsen light applications. We were therefore induced to try the preliminary use of Finsen light to break down the indurated tissues, and to follow this by exposures of X-rays to the ulcerated surface, and we found this

combination of methods more satisfactory than either separately.

II

The patient, a woman of 45, had a small raised "warty" nodule, about the size of a pea, on the right cheek, 2 in. below the eye, which she had noticed four years previously. After eight applications of Finsen light, from October 11th to 21st, 1904, the nodule sloughed out, leaving a small punched-out ulcer with a slightly raised but soft edge. The Finsen light was followed by four applications of X-rays, from November 9th to 12th, 1904, as a result of which the hard edge disappeared and the ulcer healed. As far as is known there has been no recurrence.

III

In another case of early non-ulcerative rodent the patient, a man of 40, had a hard, slightly raised thickening in the skin on the right side of the face just above and external to the ala nasi. The growth was the size of a large pea, and the edge was rolled and semi-translucent; he had never been treated for it. Finsen treatment was begun on June 29th, 1903, and after six applications the nodule was softened and a small ulcer was left. Under X-ray treatment, from July 7th to 18th, the ulcer healed and no thickening remained. On November 8th, 1904, a minute thickening of the skin appeared at the inner part of the scar. Four applications of Finsen light, followed by three of X-rays, were sufficient to remove this, and there has been no further recurrence.

PLATE XI. CASE OF RODENT ULCER TREATED WITH LIGHT AND X-RAYS. (*p. 105.*)

IV

Man aged 51 (Plate XI.).

History.—The disease began 10 years previously, "like a boil," at the edge of the left nostril. The boil "gathered" and continued to spread in spite of the application of various ointments and of two operations performed in 1899 and 1901 respectively. During the last three months the ulcer had been rapidly extending.

Condition.—When the patient came under our care, on March 11th, 1902, there was extensive and deep ulceration of the left side of the nose and cheek, as shown in the photograph. The cartilaginous portion of the left side of the nose was destroyed, and the septum and turbinated bones exposed. The right nostril was obliterated by scar tissue. The edges of the ulcer were ragged and everted, but at its upper border on the nose there was a well-defined hard glistening edge. The upper lip was involved in the ulcer and drawn up at its left extremity.

Treatment.—At first some inflammation followed the applications of X-rays, which were begun on March 11th, 1902, but by degrees the ulcer became cleaner and the base began to granulate. On April 8th the appearance of the ulcer was much healthier and the deepest part of the cavity was filled by granulation tissue. On April 12th healing was still proceeding rapidly, and the granulation tissue filling the cavity above the everted upper lip and continuous with the aperture of the left nostril, was nearly level with the surface. All the upper more superficial parts of the ulcer were covered

with granulations. On April 18th the granulating surface showed signs of inflammation, and shorter exposures were given. On April 30th a fresh lesion appeared on the right side of the nose, apparently as a result of some reaction which had been set up, the extension of the disease being shown by a small curved, whitish, elevated edge. The bone adjacent to a stump of the left upper canine tooth was also found to be affected. On July 1st there was a slight recrudescence of the disease at the lower border of the right nostril, and there was still a raised edge bordering the scar near the right angle of the mouth. A few applications of Finsen light were made to this edge.

By August 8th good progress had been made, in spite of slight relapses. All the ulceration had healed, and the patient's appearance was very much improved. The small area of bone in the upper jaw was still slightly eroded, otherwise there seemed to be no active disease, and the patient returned to his home. Altogether he had had 106 applications of X-rays and 11 of Finsen light.

Remarks.—This case illustrates the efficacy of the X-rays in bringing about rapid healing of deep ulcers. There was, however, a tendency for the disease to spread when treatment was stopped, and especially—as we have noticed in several cases—after reaction was set up in the part. The diseased bone was apparently unaffected by the X-rays. The patient's subsequent history is unknown.

Treatment with Light, X-rays, Radium, and Operation

I

The patient was a man aged 45.

Condition.—There was a small infiltration with an irregular surface and indurated edges in the skin at the upper part of the left side of the nose. The inner canthus of the eye was also involved, but it was difficult to make out the exact extent of the disease owing to the large amount of scar tissue resulting from previous operations. The lower lid was retracted and everted, and the mucous membrane exposed. There was a small puffy swelling immediately below the margin of the lid, which felt as if it contained fluid. At the inner part of the upper lid there was a small sinus with some surrounding induration.

Treatment.—Finsen treatment was begun on December 7th, 1900, and was tried for a considerable time with marked temporary improvement, but relapse always followed cessation of treatment.

From May, 1901, to July 8th, 40 applications of X-rays were given by Dr. Harrison Low, and X-ray treatment was continued by us on July 16th. The patient made rapid improvement under the rays, and all the ulcers healed, but one or two deep-seated foci remained in spite of more or less continuous treatment for eight months. Treatment was stopped on January 19th, 1902, on account of a severe reaction which lasted about a month. In July, 1902, there was an attack of dermatitis, beginning in the left orbital region, where there had previously been an X-ray reaction, and spread-

ing to the right eye and right side of the face. This dermatitis was attributed to exposure to the sun when boating. About three months later, after being exposed to cold wind when golfing, the patient again had a severe dermatitis, beginning in the region of the left eye and spreading to the right side of the face and over his whole body. In November, 1903, after an interval of a year and ten months, X-rays were begun again for two indurated nodules, one on the upper lid and one below the lower lid. In February, 1904, the eye became very painful; the orbital tissues were puffy, the conjunctival vessels injected, and a small portion of thickened conjunctiva overlapped the cornea as a result of repeated reactions.

On account of the increased sensitivity of the part to the X-rays, the whole eye becoming inflamed after a few exposures, radium was tried, 5 mg. being applied for 10 minutes daily. In March, 1904, on account of the chronic conjunctivitis and pain in the eye, which had become useless for purposes of vision, the patient was advised to have the organ removed. The operation was successfully performed by Mr. Jessop, the whole orbit being cleared out, together with the skin bordering it, as well as that from the side of the nose.

Microscopical examination kindly made by Dr. Whitfield showed the tissues to be almost free from growth. The patient made a successful recovery from the operation. Ten months after the operation (January, 1905), a small deep cavity communicating with the nose had formed at the inner angle of the orbit; the patient said that a small "hole" had remained after the operation, and had gradually enlarged since.

PLATE XII. CASE OF RODENT ULCER TREATED WITH LIGHT, X-RAYS, AND RADIUM. (*p. 109.*)

X-rays were resumed and continued for nearly six months. He returned in March, 1906 (after a seven months' interval), on account of some extension of the disease into the bone of the inner wall of the floor of the orbit. X-rays were again resumed, and continued with intervals until December. The disease was kept in check, but had a tendency to extend into the back and floor of the orbit as soon as the treatment was stopped. Radium (5 mg.) was applied daily in several positions for periods of about 20 minutes from March 13th to April 2nd, 1907, and from April 15th to 25th. The result was very satisfactory, the ulcerated surfaces having a healthy granulated appearance. Four more exposures of X-rays were given in May. The patient is still under observation.

II

The patient was a woman aged 44 (Plate XII.), whose mother died of "cancer of the throat." Father alive and healthy.

Personal History.—Very good; never laid up with any serious illness.

The disease began when she was 26 years of age, as a "small pimple" on the right cheek near the corner of the mouth. It remained in this condition for 13 years, when it began to ulcerate. It was treated with ointment at a London hospital, and improved for a time, but never quite healed. Three years afterwards she again went to the same hospital, where the ulcer was burnt with nitric acid on and off (once a month) for two years. This treatment served to keep it within

bounds, although at one time it became very much worse.

In the spring of 1902 the use of X-rays was advised at St. George's Hospital, and for two months (February and March) she had exposures, lasting about 20 minutes, twice or three times a week, but only had 10 or 12 applications altogether. Under this treatment the part inside the mouth improved, but not that outside.

Condition.—There was a slightly red, scarred area on the right cheek, which measured 1½ in. vertically and 1 in. transversely. At the part immediately adjoining and involving the angle of the mouth there was a deep ulcer, with somewhat irregular edges, ¾ in. in length and ½ in. in width. The floor of this ulcer was covered with a thick yellow crust. The mucous membrane at the angle of the mouth was also implicated. At the anterior and lower edge, below the ulcerated portion, the scar ended in a hard raised border, characteristic of the edge of a rodent ulcer. In other parts the scar was flat and smooth, and merged into the surrounding skin without any line of demarcation.

Treatment.—X-ray treatment was begun on September 24th, 1902. Improvement set in after three or four applications of 10 minutes' duration. On October 1st the ulcer was clean and beginning to granulate, and the discharge had lessened. On October 4th the part was less stiff and painful, and the patient could open and close her mouth without difficulty. Healing was progressing rapidly. By October 10th healing had well advanced, the ulcer being diminished in size by half, and its outer edge bordered by a heaped-up ridge of granulation tissue. By October 18th only a

very small ulcer remained, and ten days later it was completely covered with epidermis, leaving a smooth, healthy-looking scar.

On November 12th, although all the ulceration had healed, the narrow raised edge, about ½ in. in length at the lower and inner border of the scar, showed no signs of yielding to the treatment, and it was thought advisable to try to remove it with the Finsen light. Three consecutive applications of the Finsen rays were given, and on November 22nd a small crust remained from the effect of this measure. By the 28th the crust had separated, but a trace of the raised edge still persisted. Three more applications of the Finsen light were ordered, and by December 19th no trace of disease could be detected, and the part presented a flat, smooth scar. Up to this time the patient had had 40 applications of X-rays and six of Finsen light.

On May 6th, 1903, a slightly raised edge still remained, and X-ray treatment was resumed until June 6th.

On November 28th the patient returned with a relapse. The scar tissue at the angle of the mouth had again broken down to form an ulcer. There was also an ulcer about the size of a sixpence, with hard thickened edges, just internal to the angle. X-rays were resumed, and were directed so as to reach the buccal mucous membrane. On February 13th, 1904, the ulcer of the skin and also that of the mucous membrane inside the mouth had healed, but there was progressive ulceration on the under surface of the lower lip opposite the incisor tooth, which could not be treated by the X-rays except through the skin surface. Radium was therefore applied to this ulcer, X-rays from a high tube

being continued to the external surface. At the end of March the ulcer on the lower lip had nearly healed as the result of the radium applications, but a fresh ulcer had formed on the mucous surface of the lower lip. This was at first treated with radium, but the moisture of the part made the application of radium, which was only covered with mica, difficult, and recourse was again had to the X-rays. At the beginning of September, after an interval of four months without treatment, the ulcer under the upper lip had extended and was surrounded by a thickened edge. There was some accompanying swelling and redness of the overlying skin.

Early in November the part became red and inflamed, and the face was swollen so that the mouth could not be opened. This was attributed by the patient to a cold, but it was probably the result of the cumulative action of the rays. When the inflammation subsided there was seen to be a recrudescence of the ulceration of the buccal mucous membrane previously healed, but this healed again after a few weeks without further treatment. On January 3rd, 1905, X-ray treatment was resumed for an indurated deposit in the lower lip below the angle of the mouth, the rays being applied with the lip everted. In February another reaction occurred with a fresh outbreak of the ulceration. Radium was again used for the lower lip where the disease was progressing. On November 15th there was great improvement as the result of continued X-ray treatment; the infiltration of the lower lip was much diminished, and there was no active disease inside the mouth.

At the beginning of December treatment was suspended on account of some X-ray erythema and soreness of the part. On January 10th, 1906, after the erythema had subsided, some fresh ulceration appeared on the upper surface of the lower lip. On March 16th there was a small punched-out ulcer on the under surface of the upper lip opposite the incisor tooth, which was prominent and carious. The patient also complained of neuralgic pains in the right side of her mouth. The tooth was extracted.

Intermittent X-ray treatment was continued until the end of July. The disease was alleviated and to a certain extent controlled by the X-rays, but as soon as the exposures were stopped the growth seemed to take on renewed activity.

At the end of November, 1906, little further progress had been made. Owing to the increased sensitiveness of the part to the rays only very small doses could be given, and these were not sufficient to keep the disease in check. Painful erythema was very easily set up, and the perpetual dribbling of saliva from the mouth caused the patient constant annoyance. As the rays seemed to have lost their power of controlling the disease, it was decided to obtain the advice of a surgeon as to the desirability of operative procedure. Mr. Cheatle kindly saw the case for us and undertook to remove the diseased structures. This was done at King's College Hospital in February, 1907. After a preliminary laryngotomy, large portions of the superior and inferior maxillæ were removed with the corresponding soft parts and a considerable area of healthy skin round the ulcer of the cheek. The patient made a

rapid recovery from the operation, and is now practically free from trouble with the exception of the inability to swallow her saliva, which runs from her mouth as it did before, but which, it is hoped, will be remedied by a further plastic operation.

Summary of authors' results.—In 32 cases in which the lesions were of small extent, *i.e.* up to a shilling in size, the results were satisfactory, but the majority of them had slight relapses before a permanent result was obtained.

In the cases in which ulceration had not occurred we found a few preliminary applications of the Finsen light useful to soften the edge and reduce the number of subsequent X-ray exposures. In more extensive ulcerating cases (of which we had 12) healing of the ulcers was rapidly brought about, but in some of the cases the hard edge was troublesome and relapse was more frequent.

In six deep ulcerative cases with invasion of bone or periosteum or mucous membrane the immediate results were very satisfactory as regards healing of the ulceration, but small burrowing foci remained in most of them and went on spreading in spite of continued treatment, and in three the parts became so sensitive to the rays that adequate doses could not be given. In such cases we have found radium useful for its greater penetrating effect.

In six cases of small raised warty growths in which the clinical diagnosis of rodent was uncertain, a few applications of the Finsen light alone effected a cure.

CHAPTER IX

X-RAY TREATMENT OF OTHER NEW GROWTHS, MALIGNANT AND BENIGN

Carcinoma: Results and prospects—Application to deep-seated cancers—Dosage—Histological changes. Sarcoma—Paget's disease—Mycosis fungoides—Cheloid—Hypertrichosis—Nævus—Cutaneous warts

Carcinoma

Results and prospects.—In view of the acknowledged curative effect of X-rays on rodent ulcer it would seem reasonable to expect a similar action in carcinomatous growths. Unfortunately the results have not come up to expectations, and the method, although there may be hope of better results with improved knowledge and technique, has on the whole proved disappointing. More particularly is this the case with deep-seated cancer affecting internal organs. The X-rays are, as far as present experience goes, applicable to the treatment of carcinoma only with strict limitations. The progress of rodent ulcer is so slow and metastasis so rare that there is no risk in the employment of measures which take some time to produce their effect. On the other hand, in the case of carcinoma every hour is of importance, and in all cases where the disease is still completely within reach of the surgeon's knife, immediate operation is imperative. But in cases

that are past all surgery there is room for hope of considerable palliation, if not of cure, from the use of the X-rays. The drying and healing effect of the rays on ulcerating surfaces in lupus and rodent ulcer has already been pointed out. The same holds good, though to a less extent, with regard to the ulcerations of malignant disease. The most marked effect of the rays, however, in cases of cancer is the relief of pain and discharge. In this way life has been made fairly comfortable in many cases where alleviation was previously impossible. But although the palliative effect is considerable, the hope of complete removal appears to be confined to superficial cases.

Application to deep-seated cancer.—After penetration of the skin the effect upon deep-seated tissues is uncertain, and, according to some authors, non-existent. In order to produce an effect, either very penetrating rays must be used, in which case they may pass right through the tissues without being absorbed by them, or rays of a lower degree of penetration must be employed for considerable periods, when there is the risk of dermatitis of the skin. The difficulty has been partly overcome by covering the skin with some substance which will absorb the slightly penetrating rays while allowing more deeply penetrating rays to pass, and "filters" of saline solutions have recently been employed to cut off the harmful rays. Belot recommends the use of rays of medium penetration, corresponding to No. 7 of Benoist's scale, which are of sufficient penetration to reach the tumour, and are less injurious to the skin, which in these cases is peculiarly sensitive.

Another direction in which the rays may be usefully and often successfully applied is in the treatment of recurrences after operation. Some authors also advocate their use as a prophylactic against recurrence.

Dosage.—In treating a case of carcinoma the operator must be guided by the character and extent of the disease; some writers advise massive doses, others small ones. The possibility of toxæmia referred to above must be borne in mind, and also the danger of stimulating the growth or causing metastasis. Ulcerating surfaces will usually take larger doses, but in our experience carcinomatous ulcerations are unusually susceptible, even small doses being sufficient to set up reaction. In several cases of inoperable sloughing epitheliomata of the mouth treated by us, the activity of the process has been delayed and an attempt at repair has been made as a result of weak daily exposures to the rays. Although decided relief resulted, in none of the cases was the benefit permanent.

Histological changes in carcinoma.—The microscopical changes occurring in carcinomatous growths as a result of exposure to X-rays have been investigated by numerous observers. In one case Scholtz was able to obtain excisions in the stage of beginning reaction and also after the formation of a superficial necrosis. The microscopical examination showed that the cancer cells degenerate and are destroyed, just as with the normal epithelial cells. The degenerative processes, however, were only recognisable, especially in the deeper parts, after a relatively more intense action of the rays, and the appearances were

often difficult to distinguish from the normal retrogressive processes.

In a case excised after eight exposures of 10 minutes at a distance of 8 in., fixed with Fleming's solution and stained with safranin, there were numerous beginning mitoses, but the normal course of mitotic division was nowhere seen. The cells were filled with intensely stained fibrils and bunches of varying thickness, but no division occurred; the chromatin seemed to reunite into single rings and bunches.

Ellis found necrosis of cells and trabeculæ in varying degrees, increase in elastic tissue, a tendency to occlusion of vessels by deposits on their inner surfaces, and practically entire absence of infiltration by polymorphonuclear leucocytes.

Pusey examined tissue taken from carcinomata in various stages of subsidence under the influence of X-rays, and found practically identical changes in all. As described by him, "the first changes occur in the cells at the periphery of each nest of carcinoma. Later the same process involves all the mass, invading in succession the cells from the periphery to the centre. These cells are found in various stages of destruction, or, if such it may be called, necrosis. The term 'necrosis,' however, as ordinarily used, does not accurately describe the process as it occurs under X-rays. In the ordinary form of necrosis the cells retain more or less completely their form, and the first change noticed is in the nuclei, which fail to take the basic stain, while the tissue in general takes a diffuse acid and basic stain, apparently a mixture of the two. On the other hand, in the tissue breaking down under X-rays the cells and nuclei lose their out-

line; the chromatin of the nuclei appears to become spread out and mixed with protoplasm of the cells, where it is frequently seen as streaks or more or less irregular areas staining a rather bright blue and to a certain extent resembling mucoid degeneration. The blood-vessels, especially the small ones which are in close relation to the tumour, show marked endarteritis, completely occluding the lumina of the vessels. Around the occluded blood-vessels the breaking-down of tumour cells is decidedly more pronounced than at any other place, even at the periphery of the cell-nests. The tumour cells gradually disappear by a process which appears to be some form of cytolysis, which is then followed by their absorption."

"Practically all observers agree in describing two sorts of changes: first, evidences of peculiar structural changes in the cells themselves; second, certain proliferative changes in the inner coats of the blood-vessels.

"The process is one primarily affecting the tissue cells themselves. There is evidence first of stimulation of cellular activity, and later, if the effect is at all intense, there follows disorganisation of the affected cells. The changes occur first and most markedly in the epithelium, and next in the blood-vessels, but it is likely that they develop also, though to a much less degree, in the cells of all the tissues of the affected area."

According to W. F. Brook, the epithelial elements of the cancer disappear, but the fibrous tissue remains unchanged, the loosening of the adhesions being due rather to general relaxation from diminution in bulk

than to any dissolution of cicatricial tissue. In a case under his care in which the lump, after 50 exposures gradually increased to three-quarters of an hour, was reduced to half its original size, excision was performed, and an examination of the tumour was made by Mr. Shattuck, who reported to the Pathological Society of London that no degeneration of any kind or cell lysis had been induced in the carcinomatous epithelium, no phagocytic invasion of the epithelium was in progress, and on every side the growth was in an extending condition. There was nothing in the amount of lymphocytic infiltration in the mast cells and Unna's plasma cells which might not be met with in cases where no treatment had been carried out. The clinical diminution in size of the mass and the loosening of its deep connections were difficult to explain; possibly they were due to the disappearance of a sub-inflammatory œdema. Mr. Shattock expressed "profound disappointment" at such a negative finding. A more recent writer on the subject, E. A. Codman, of Boston, thinks the effects of the X-rays in cancer are due to stimulation of the nutrition of the part rather than to destruction of the malignant tissue.

Dr. J. Galloway made a histological examination of a piece of skin excised from a case of scirrhus of the breast treated by X-rays by Dr. Batten, and previously operated on by Hutchinson. The epithelium was thinned, but the various layers were quite distinguishable. In the stratum mucosum three of these could be made out, the deepest of which—the palisade layer—was more irregular than usual. The cells of the stratum mucosum were normal. The stratum granulosum was

not very distinct. Its cells, few in number, were scattered over the subjacent epithelium. Seen in section, there were intervals between the cells, which were, however, numerous enough to allow of the formation of a complete living layer. The cells of the stratum corneum were well cornified, and formed a complete layer, although the cells were not so close together as normal. There were no interpapillary extensions of the epidermis, and the papillæ themselves had almost entirely disappeared. The corium showed bands of connective tissue interspersed with nuclei, giving it a somewhat cicatricial appearance. The papillæ had almost completely disappeared, the surface of the corium having a slightly undulating appearance. Near the surface were foci of leucocytic infiltration, showing that there had been some inflammatory reaction. There was no enlargement of the vessels of the epidermis. In no portion of the section were there any signs of cancer tissue.

Sarcoma

Early hopes of the cure of sarcoma by radiotherapy have not been fulfilled. Numerous instances of the removal of sarcoma have been reported by Pusey (11 cases), Bowen, Kirby, Williams, Kienböck, and other authors. Of 74 cases, the literature of which was analysed by Spring, 17 were cured, 5 were improved, and life was prolonged in 47. Varney reported on 13 cases, all of which showed recurrence or death. Coley treated 25 inoperable cases without favourable result. He concludes (1) that the great majority of cases are but little affected by the use of X-rays; (2) that in a certain small proportion of cases the tumour decreases rapidly

in size, and in a few instances may totally disappear; (3) that in all of the cases so far observed, with one exception, there has been either local or general recurrence, although in some few cases life has undoubtedly been considerably prolonged; (4) that the very small percentage of cases in which the tumour has disappeared, and the almost universal tendency to early recurrence even in these cases, are sufficient reasons for never advocating the method except in inoperable or recurrent cases.

Paget's Disease

Of the limited number of cases of this affection treated by X-rays, the majority have shown very favourable results. Cures have been reported by Pusey, Meek, Bisserié, and Belot. Recently Jungmann and Pollitzer have reported an extensive case accompanied by a carcinomatous tumour in the axilla, in which the ulcerating surface of the breast showed a remarkable improvement, but there was also decided diminution in the size of the tumour in the axilla, the patient's general condition at the same time being greatly improved. Stelwagon observed improvement in a case under his care. Hartzell reports two cases, and concludes from the results of the treatment and from the microscopical study of one of them that the careful, systematic, and prolonged use of X-rays may completely and permanently cure the disease of the areola and nipple; but he also believes that this agent has very little effect upon the epithelial proliferation in the ducts of the nipple and in the alveoli of the mammary gland. If, he says, Paget's disease is in the beginning limited to the areola and surface of the nipple, the ducts and

mammary gland becoming involved only after some considerable time, then we may hope, by the early and persistent use of the X-rays, to bring about a complete and lasting cure; but if the ducts and gland are involved in the process from the beginning, the knife should be our first and not our last resort. Dr. F. J. Shepherd advises immediate amputation of the breast and adjacent lymphatic tissue without waiting for the result of X-rays. With this opinion Dr. Nevins Hyde agrees. Dr. F. H. Montgomery mentions two cases of cure, but in one of them a recurrence took place in the neighbourhood of the original site of the tumour after two or three years.

Mycosis Fungoides

This terrible disease, on which no treatment previously tried had any effect, has to a certain extent yielded to the X-rays. Allan Jamieson has recorded a case in which "not only did the tumour melt wholly away, but the thickened patches likewise disappeared under the influence of the rays." Jamieson thinks that "what has been accomplished in the way of cure of the fully established disease warrants the hope that, attacked betimes, still better results will be obtained." A striking illustration of the beneficial effects of the rays in mycosis fungoides was displayed at a meeting of the British Society of Dermatology by E. Stainer (*Brit. Journ. Dermat.*, June, 1903). The patient appeared to be completely cured—for the time at least. Cases have also been shown by Radcliffe Crocker and Pernet (*Brit. Journ. Dermat.*, November, 1904).

Cheloid

X-rays are certainly worth a trial in cheloid, a disease in which surgery is powerless to effect a cure. Complete removal is reported by some authors, great improvement by others. Pusey had a case in which cure resulted after a severe dermatitis. In a case of extensive cheloid of the buttock, treated by Crocker with 14 exposures of 15 minutes, the growth was a quarter of its original size after the inflammatory reaction had subsided.

Belot reports on four patients treated with good results at the Broca Hospital. He considers that a violent reaction should be avoided, and a dose of 6 or 7 H. was seldom exceeded. The exposure may be repeated every 15 or 20 days, according to the state of the integument. The cheloid begins to soften and diminish after the second or third *séance*, the surface becoming rose-coloured, with a slight amount of pigmentation.

In a case of painful cheloid under our care the growth became softer and smaller in extent and thickness, and some of the pain and stiffness were removed. In some of the other cases treated by us with the rays there has been decided diminution of the growth. The effect of the treatment in easing pain has been very marked.

The light treatment, in our experience, is less satisfactory, but in one case in which it was applied as a supplement to radiotherapy it yielded good results. The patient, aged 24, suffered from cheloid thickening of the edges of a skin graft on the nose applied after lupus had been excised for the second time. When first seen there was a yellowish-white smooth patch on the right

ala of the nose, corresponding to the graft, bordered by a well-defined raised and indurated edge of a pinkish colour. Treatment by X-rays considerably reduced the thickening, and the skin became more supple and natural in colour. After an interval of several months Finsen light was employed, with the result that still further improvement ensued.

Hypertrichosis

As early as 1898, Schiff and Freund, following their pioneer work of employing the X-rays for therapeutic purposes in a case of hairy nævus in 1897, reported successful results in six cases of hypertrichosis. A hard tube was used at a distance of 6 in. from the skin. Short exposures were given, and repeated daily until the skin was slightly discoloured. The hairs fell out after from 20 to 25 sittings. New hairs began to appear in from five to eight weeks, and to prevent re-growth supplementary exposures were given once a month and continued for 12 to 18 months. Many cases treated in this way remained free from recurrence after two years. Pusey regards the treatment as only a qualified success. Kienböck, Holzknecht, Jutassy, and many other authors agree that permanent removal of hair can be obtained, but often at the expense of atrophy, telangiectasis, and pigmentation of the skin, and they advise caution in the treatment and in the selection of cases.

In ordinary cases of hypertrichosis we regard electrolysis as the safest and surest method, but in some severe cases which cannot be treated in this way X-rays hold out the only hope of amelioration. Patients must be warned not only of the possibility of dermatitis, but

also of the late appearance of pigmentation, atrophy, and telangiectasis. On account of these sequelæ, results which appear highly successful at first may eventually prove to be anything but satisfactory. Most observers agree that the removal of downy hair is difficult, and, on the other hand, cases may occur in which strong, coarse hairs cannot be removed without giving a larger dose than the skin of the face—which is more sensitive than that of the scalp—is able to bear without dermatitis. The majority of reported cases have been treated with small repeated doses, smaller doses being required after epilation has occurred to prevent recurrence. Some authors prefer to give a full dose of 3 or 4 H., varied according to the sensitiveness of the skin—short exposures of five to ten minutes being given subsequently about every two months to prevent re-growth (Belot).

Nævus

Vascular nævi appear to be curable only by setting up dermatitis and superficial necrosis of the part. Jutassy cured a case in this manner, and Scholtz brought about a temporary cure of a pigmented nævus, but failed with vascular nævi. Belot obtained "vast improvement" of a "port-wine mark" after causing violent dermatitis. Dickson and also Pfahler record successful cases.

Cutaneous Warts

Belot reports excellent results in the treatment of warts and cutaneous horns. Scholtz procured disappearance of warts of the scalp by moderate irradiation without the production of alopecia; he also removed a cutaneous horn with X-rays, but a case of warts on the

hand was treated with an intense irradiation without effect. In one of Belot's cases all the warts were cured except one on the thumb which had not been exposed to the rays.

A fairly large aggregate dose of the rays seems to be required to give good results. We have seen warts completely disappear after X-ray treatment, but in some cases they have recurred. A case of multiple warts of the hands came under the care of one of us, in which severe telangiectasis occurred several months after the exposures. The patient was not under our treatment, but she stated that a severe dermatitis was set up at the time of exposure. These serious after-effects must be borne in mind, as it is probable that in order to remove the warts a sufficient amount of X-rays must be given, either in a single or many exposures, to endanger the integrity of the tissues.

CHAPTER X

X-RAY TREATMENT OF RINGWORM

Sabouraud's results—Single or multiple exposures ?—The pastille method — Precautions before treatment — Difficulties of the treatment—Epilation of the whole scalp—Varying the method of procedure—Epilation and re-growth—Incomplete epilation — Re-infection — After-treatment — Complications —Authors' results

Cases of ringworm treated with X-rays were first shown by Whitfield at the Dermatological Society of London in January, 1903, and by Sale Barker on January 11th, 1905. MacLeod, Adamson, Sichel, Sequeira and many others have written on the subject.

Sabouraud's results. — The treatment of tinea tonsurans by means of X-rays is now generally adopted on account of the large amount of time and trouble saved by this method. According to Sabouraud, ringworm was formerly cured on an average in 27 months; it is now possible to cure it in six weeks. The cure of a case of ringworm at the Hospital of St. Louis used to cost on an average 2,000 francs; it now costs 260 francs. Sabouraud stated that with the application of X-rays to ringworm the Assistance Publique would recover at the end of that year (1906) a capital of two and a half millions of francs; and, further, it makes now, and will continue to make, a saving certainly exceeding 300,000 francs per annum, a sum which will increase from year

to year. Moreover, Sabouraud and his assistants hope within a very few years to erase even the memory of the epidemics of ringworm which Paris has experienced.

Single or multiple exposures?—The treatment consists in removing the hair from the affected part, the fungus not being killed by the rays but mechanically removed with the diseased hairs. A given area may be epilated by a single exposure or in a series of exposures, and there has been, and still is, a good deal of difference of opinion as to the relative merits of these two methods. The multiple exposure method was the first adopted, and is still advocated by some competent workers. We treated a considerable number of cases in this way with satisfactory results. In hospitals, again, some operators prefer to give daily short exposures until the hair comes out rather than take the risk of attaining the same end in one long exposure.

The single exposure method is undoubtedly the ideal one, the chief objection hitherto being the want of an exact method of dosage. The production of epilation in a single exposure involves the risk, on the one hand, of failure to cause defluvium on account of the dose of X-rays falling short of the required amount, or, on the other hand, of causing a dermatitis if the dose slightly exceeds the limit.

The pastille method.—Sabouraud has to a large extent overcome the difficulty of estimating the exact amount of rays required to produce epilation by employing pastilles of platino-cyanide of barium, which are changed to a standard colour when they are exposed to the rays for a certain length of time, and which he now uses in place of Holzknecht's radiochromometer.

The pastille is placed on a metal surface midway between the anode and the skin, in the direct path of the rays, and in such a way that it is not exposed to daylight. A lead-glass cylinder (Sabouraud uses metal localisers) which is of such a length as to give the correct distance (15 cm., or about 6 in.) between the skin of the patient and the anticathode is then fixed to the shield enclosing the tube, and the affected part of the scalp is exposed until the requisite tint (*teinte* B) is reached. The length of exposure varies with the intensity of the current and the condition of the tube, and may be as short as six or seven minutes (Sabouraud) or as long as three-quarters of an hour. It is obvious that the risk is increased as the length of exposure is diminished, and Sabouraud gives sittings of 10 to 15 minutes in order to allow a margin for error on the part of the operator.

The quality of the rays can be measured by a radiochromometer, an instrument composed of different thicknesses of aluminium, each of which can be compared with a standard thickness of silver. Recently, however, Sabouraud has stated that the quality of the rays is not important, and that it is only necessary to ascertain the number which traverses the surface to be treated, the therapeutic action being in direct ratio to their number. By employing the pastilles in the manner indicated Sabouraud effected 327 cures in the first year (1903 to 1904) and 504 cures in 1905.

Precautions before treatment.—Any inflammation of the scalp from previous treatment or other cause should, if possible, be allowed to subside before applying the rays, as the reaction is apt to be increased in such

cases. Seborrhœic dermatitis or pus infection should also be removed.

Difficulties of the treatment.—The chief difficulty is that just mentioned of giving the correct exposure. Sabouraud claims that his pastilles are infallible, and does not recognise an idiosyncrasy, at any rate where the scalp is concerned. Other workers, however, think the pastilles untrustworthy, and contend that under certain conditions an excessive dose may be given without a corresponding change in the pastille.

The precautions which, according to Sabouraud, must be taken with the pastilles are as follows:—

1. The distance of the pastille and the area exposed from the anticathode must be accurately measured.

2. The pastille must be protected from daylight during exposure to the rays.

3. A metal disc or screen must be placed behind the pastille.

4. The pastille must be at a short distance from the tube so as to avoid its being heated by the tube.

To these Dr. Adamson adds the following:—

5. The pastille must be fixed in a position as nearly as possible in the axis of those rays to which the area under treatment is exposed.

6. An exposure should not be made except while there is good daylight for comparison of the tint of the exposed pastille with the standard tint. The comparison cannot be made by artificial light, nor accurately in strong sunlight, nor in fading daylight, but only in diffuse daylight near a window.

7. Pastilles of one manufacture should be used. Different makes of pastilles vary in their susceptibility

to the action of the rays. German imitations of the French books of pastilles, with their standard B tint very much too dark, should be used with caution.

The necessity for these precautions indicates the possible sources of error underlying the use of pastilles as an absolute criterion of correct dosage. The fact that the appreciation of slight shades of colour varies with different people introduces another difficulty, and, as a matter of fact, the coloured surfaces of the standard and the exposed pastille, being of different material, cannot be exactly matched.

The pastille-holder should be placed in an accessible position, so that it may be quickly removed for observation and replaced. If its position is altered or the anode has not been correctly centralised, only the edge of the pastille may be exposed to the rays. In our opinion it is better to give fairly long exposures (15 to 20 minutes) rather than short ones, for in the latter case the effect of a slightly excessive dose will be intensified.

Although we have had better results since we have used Sabouraud's pastilles, which we have employed in connection with the radiogenometer (Plate III.), we do not think it advisable to depend upon them alone. The milliampèremeter, ampèrage in the primary, spark-gap, appearance of the tube and anode, time of exposure, &c., must all be carefully watched and kept as constant as possible, so that any fallacies due to the pastille may be avoided. We find it advisable to use tubes that have been in use for some time and whose action can be depended upon, and not to use the same tube for many consecutive exposures.

Other difficulties which occur in the X-ray treatment of ringworm are those of keeping the patient still and of correctly mapping out the diseased areas. In young children it is sometimes almost impossible to keep the lead-glass cylinder applied exactly to the same spot for the required time.

There is often great difficulty in locating the disease, and to facilitate this the hair should be cut short before the treatment is begun. In spite of this precaution small foci of infection may easily be missed. The disease is often more extensive than it appears to be, and sometimes after the scalp is denuded there may be seen surrounding the original patch a red ring which was not apparent before. It is always advisable, therefore, to treat a much larger area than is obviously affected, and so to make sure of including any satellite foci that may have escaped notice, and also of rendering the scalp less liable to re-infection.

Epilation of the whole scalp.—In many cases where the disease is disseminated or large areas are affected it may be necessary to remove all the hair from the scalp. Sabouraud accomplishes this in about 12 consecutive sittings by exposing circular areas to the rays and then covering these with lead discs, kept in place by means of elastic bands, while adjacent areas are being treated. It is no doubt an advantage to complete the treatment in one day, but it increases the risk from overlapping and from over-exposure, should this have happened in several areas; moreover, the time required is longer than some children are able to bear or the operator is able to give, and it also makes a considerable demand upon the tubes.

In some cases we have treated large areas of the scalp with an unscreened tube; in this way the two sides of the scalp can be treated first, and the back and top of the head can be left until the hair has fallen from these regions. The disadvantages of treating large areas are that the central part of a large convex area receives a relatively stronger radiation than the peripheral part, with the resulting danger of causing either dermatitis of the centre or insufficient depilation of the periphery; moreover, when the distance of the tube from the skin is increased accurate pastille dosage is impossible.

When treating adjacent areas on the same day we have tried various devices to mark out the head into areas which could be treated separately without overlapping. Elastic bands, for instance, were fastened around, transversely across, and along the scalp in a longitudinal direction, the intervening spaces being covered in with lead-foil held in position by the elastics.

We also used upright partitions made of cardboard covered with lead, one being sickle-shaped and crossing the head longitudinally, and a second at right angles to this, thus dividing the scalp into four sections, each of which could be treated separately, the partition preventing the rays from reaching the other parts of the head. A wire framework was also tried. But all these devices were more or less unsatisfactory on account of the liability of the apparatus to get out of position and because the difference in the shape of children's heads makes almost any contrivance of this kind unsuitable.

Varying the method of procedure.—The method adopted may be varied according to the position and

size of the affected areas. In disseminated cases, when it is necessary to denude the whole of the head, our usual practice is to expose three or more areas on distant parts of the scalp, and to wait until epilation of these is completed before treating the remainder. By this method, which appears to us to be preferable to that of epilating the whole scalp in consecutive applications, the disadvantages of overlapping or leaving small intervening areas unexposed are avoided; the results of possible over-exposure are limited to a comparatively small area; and the dose may be corrected if necessary for ensuing applications. In less extensive cases, when *adjacent* areas must be treated, Sabouraud's method is not attended by the same disadvantages; each circular area is marked out with ink or with a blue pencil and covered with a lead disc, while neighbouring parts are being exposed. If the treatment cannot be completed on the same day, great care must be taken that the mark is not washed out.

Epilation and re-growth.—With the exception of a slight transient erythema, sometimes seen about the seventh day after the exposure, nothing occurs until the fourteenth or fifteenth day, when the hair begins to loosen and fall, defluvium being complete in about three weeks. In the case of slight under-exposure depilation may be delayed for a week or more, and is then usually incomplete. Re-growth of hair begins in about six weeks, and is complete in from three to four months.

Incomplete epilation.—When the defluvium is incomplete, as at the periphery of a large area, the hairs often take the appearance of alopecia areata

hairs, or are broken off, leaving little infective stumps in the follicles. The short atrophic hairs often give rise to trouble on account of their resemblance to infected hairs, but when they are examined microscopically they are usually found to be free from fungus. The embedded stumps, on the other hand, may contain fungus, and may give rise to re-infection on other parts of the scalp. They may be removed by daily washing or with forceps or a needle, but they will eventually be extruded from the follicles without infecting the new hair beneath them.

If the first application fails to produce epilation, at least a month must be allowed to elapse before re-exposure. With recent improvement in dosage, failure is, fortunately, a rare event.

Re-infection.—This may occur during the interval between the exposure and the falling of the hair, but is most likely to result later from the loose fungus-containing hairs becoming scattered about the scalp. Re-infection may also result from small stumps which remain in the scalp after the rest of the hair has come out.

Re-infection from other cases during the course of treatment is not precluded, and is more likely to occur where many children are frequently associating, as in schools, than in private practice or even in hospital patients. The bald scalp is less likely to be re-infected than the hairy parts, although we have seen this occur in several instances.

After-treatment.—In the period between the exposure and the falling of the hair, and particularly when the hair is falling, the scalp should be kept

greased with an antiseptic ointment or, according to Sabouraud's procedure, covered with weak tincture of iodine.

If large areas of the scalp are infected it is advantageous to have the head washed every day; but if there is only a single patch, or a few small foci, there is perhaps less risk of the disease being spread if the whole head is not washed. Sequeira paints the head with collodion to prevent the falling hairs from infecting the rest of the scalp. When the hairs are loose it is sometimes useful to remove them with forceps. Linen or paper caps should be worn, and the same precautions taken to avoid infection as in the older methods of treatment.

Complications.—In addition to a complicating pus infection or seborrhœic dermatitis, dermatitis and alopecia may supervene. In several of our cases there has been a marked erythema of the scalp, which has persisted after the hair has fallen; it has, however, always cleared up in a comparatively short time, and has never caused a permanent alopecia, although the re-growth of hair has been delayed. Even in cases in which there has been severe pus infection, the hair has returned in due course. We have never seen the cicatricial atrophy without dermatitis described by Sabouraud. The new hair is often darker in colour, and may also become slightly curly, or, according to Sabouraud, "Ethiopian" in appearance.

Authors' results.—Of 70 cases of ringworm of the scalp treated by us, in 21 the disease was extensive, necessitating complete or nearly complete denudation of the scalp. Of these 21 cases, 11 were treated by the multiple and 10 by the single exposure method. In

the former (multiple exposures) each area received an average of five exposures of from 10 to 20 minutes' duration, an unscreened tube was used (the distance from the skin being varied according to the size of the area exposed), and the parts not requiring treatment were protected by a lead mask. In the latter (single exposures), Sabouraud's pastilles and a milliampère-meter were used in eight cases, the length of exposure being about 18 minutes, at a distance of 6 in. from the anode. In the remaining two the condition of the tube, equivalent spark-gap and ampèrage of the primary current were taken as the criteria of dosage, and the time of exposure at 8 in. from the anode was about 25 minutes.

In the 49 cases of small or medium extent, 9 were treated by multiple and 40 by single exposures. Of these 40 cases, 30 were treated without and 10 with the use of Sabouraud's pastilles. In the single-exposure cases, in which pastilles were not used, we worked in the first instance on a 200 and subsequently on a 240-volt circuit with a series resistance, a mercury jet interrupter, a primary current of $2\frac{1}{2}$ to 3 ampères, a tube giving an equivalent spark-gap of about 4 in. and penetration corresponding to No. 6 on Benoist's radiochromometer, the exposure lasting about 25 minutes. In these cases, (treated without a pastille) incomplete epilation or failure of epilation occasionally occurred, and in a few severe erythema resulted from over-exposure, but in only one was this followed by loss of hair. In this instance four exposures of 25, 30, 15 and 30 minutes respectively were given at intervals of more than a month to a small patch of ringworm in the right temporal region of a boy with dark, coarse hair. The

first three exposures failed to cause epilation; after the fourth a vesicating dermatitis ensued and was followed by a small cicatricial patch upon which no new hair had grown nine months later. In several of the cases the treatment was delayed on account of severe pus infection of the scalp, which appeared in almost epidemic form in a series of cases from a public institution, but none of our private cases became infected in this way.

Since using pastilles we have had a few cases of partial epilation necessitating a second exposure, and in one or two a mild degree of erythema has occurred, but of the total number of 70 cases, with the exception of the one mentioned, the ultimate results were successful both in the 52 cases treated without and in the 18 treated with the use of pastilles.

CHAPTER XI

TREATMENT OF VARIOUS OTHER AFFECTIONS

Acne — Alopecia areata—Eczema—Favus—Furunculosis — Hypertrophic scars—Indolent ulcers and wounds—Leprosy—Pruriginous dermatoses—Psoriasis—Seborrhœides—Sinuses and fistulæ—Sycosis

Acne and Rosacea

Treatment with X-rays.—Gautier, of Paris, successfully treated 16 cases of acne vulgaris and acne rosacea by daily short exposures of X-rays. Schiff and Freund had satisfactory results in obstinate cases of acne vulgaris and in rosacea, but the treatment did not prevent relapse. In 15 cases of acne, Campbell reports cure in 9, and in 3 there was no recurrence. In the others the improvement was partial. Ullmann treated a case of inveterate acne of the back with 50 applications of half an hour's duration. After 10 or 12 exposures a pronounced erythema developed. The result was a complete cure, leaving an intense pigmentation of the skin. Pusey reports improvement in 11 cases of acne which were not otherwise amenable to treatment. Allen, treating all varieties of acne with X-rays combined with other methods, concludes that the rays are of especial service in the inveterate pustular forms with deep-seated suppurating lesions, dermal abscesses, and intracutaneous infiltration.

Hahn, Jutassy, and other observers have obtained good results in rosacea.

In one of our cases of acne vulgaris the patient was a young man who had suffered from severe acne of the face for about a year. There were closely aggregated comedones and inflammatory papules on both cheeks, interspersed with numerous small scars. The first effect of X-ray treatment, three times a week on alternate sides of the face, was to cause some aggravation of the lesions, which became more pustular. After 12 exposures the pustulation and redness of the skin began to subside, and after 18 all the pustules had disappeared from the left side of the face. After 20 applications the condition had practically cleared up, only a few small papules remaining. Treatment was discontinued after 30 exposures, and the patient has not since returned.

In another case of severe acne, in a man aged 24, the affection was of six years' duration, and no treatment had been successful. Both sides of the face and neck were covered with acne lesions and extensively scarred. The shoulders, upper arms, and back were also extensively affected, and there were numerous large indolent papules and pustules in these situations. Three exposures of X-rays were given every week, beginning in November, 1904. The initial improvement was very rapid, a few exposures being sufficient to cause the disappearance of the majority of the lesions from the face, while those on the shoulders and back became less inflammatory. The improvement then became less rapid, owing to the continual appearance of fresh lesions on the back and shoulders, although these were much less severe than at first, and less persistent. At the end of

June the skin was practically clear, but after an interval of three months more treatment was required for a fresh crop of papules. No further applications were required for nine months, the patient returning for a few exposures in October, 1906. He has now had no treatment for seven months.

But though numerous observers have thus testified to the efficacy of X-rays in this disease, there is some difference of opinion as to the time required for the treatment and as to the frequency of relapses. We have found that the first result of medium exposures is often to aggravate the disease, the papules or pustules becoming more numerous and more accentuated; this gives way to gradual improvement until, after a considerable number of exposures, fresh lesions cease to appear. In our experience relapses are not uncommon at first, and the patient will probably require one or more repetitions of the treatment before a permanent result is obtained. The production of a slight erythema is beneficial and shortens the duration of the treatment; probably it is necessary to produce some amount of atrophy of the sebaceous glands before the process becomes quiescent. Even the most severe cases seem to yield to the treatment if it be sufficiently prolonged. Allen speaks well of the effect of X-rays on acne necrotica, and we have had one successful case.

It is important to remember that X-rays will not prevent scarring when the patient comes under treatment with severe pustular acne, and if he is not warned of this he may attribute the scarring to the treatment.

Treatment with light.—Of 25 cases of rosacea treated by Finsen, 13 were cured; Leredde had good

results in six cases; and in eight cases treated by Loeb all were cured.

Alopecia Areata

Treatment with X-rays.—Since small doses of X-rays undoubtedly have a stimulating effect on hair-growth, it seems rational to employ them in the treatment of this complaint. On the other hand, doses sufficient to cause epilation, as in the treatment of tinea, are usually followed by a rapid growth of hair which is often stronger than before, and for those who believe in the parasitic causation of alopecia areata it is reasonable to remove any presumably infected hairs that may be present and trust to a rapid re-growth of healthy hair. But it must be remembered that the X-rays, at least in ordinary therapeutic doses, are not bactericidal. Favourable results have been reported by Holzknecht and others, and Belot quotes a case treated by Kienböck in 1900 in which a normal growth followed epilation of the rayed parts, the alopecia persisting on the unexposed parts of the scalp. No benefit is likely to be derived in cases of total alopecia or in those due to cicatricial destruction of the hair follicules.

Treatment with light.—Out of 29 cases Finsen had 22 cases of recovery, 1 under treatment, and 6 in which treatment was stopped. Bang and Helm had good results, and Gottheil was successful in one case. Jersild treated 6 patients with no relapse. Noiré treated 50 cases, and found the method most useful when the plaques were limited and the skin was thin and atrophic. In other forms he found it no better than older methods. In one case treated by us new hair

grew on the areas treated, but the re-growth was not permanent.

Eczema

Treatment with X-rays.—Good results from radiotherapy have been reported by Hahn and Albers-Schönberg, Hyde, Montgomery, Ormsby, and others. Childs treated a case of eczema of the perineum and thigh in which the itching and then the eczema disappeared after six exposures. Some authorities have obtained good results in vesicular eczema. In rebellious cases of chronic dry eczema, radiotherapy has been employed with good results. In one such case, in which the hands and fingers were affected, we were successful in removing the eczematous patches on several occasions, but the treatment did not prevent relapses.

In another case which came under our care the patient had suffered from chronic eczema of the nipples for four years. In 1902 and 1903 she had X-ray treatment, with the result that the condition was temporarily healed, but it "broke out" again in November, 1904, and she came under our treatment on December 12th, 1905. There were two discharging thickened eczematous patches with a well-defined border surrounding the nipples and extending beyond the areolæ. After four exposures of X-rays the soreness disappeared and the discharge ceased, leaving the skin dry and smooth, but still slightly infiltrated. After three more exposures at the beginning of January all the soreness and thickening had disappeared, and only slight redness and scaliness remained. Four exposures were given at the beginning of February, after which no eczema was visible, but there

was still a little thickening of the areolæ, especially on the left side. Four more applications were given at the end of February with a view to prevent possible recurrence, and the patient has not been seen since March 1st, 1904.

Favus

Treatment with X-rays.—The treatment of favus by X-rays, as far as the hair itself is concerned, is the same as that of ringworm, and the tedious and troublesome process of epilation by forceps is now superseded by X-rays. Scutula appear to be less easily dealt with. The treatment is highly spoken of by Schiff, Norman Walker, and others. All Schiff's cases remained permanently cured. It may be doubted, however, whether this result was due exclusively to the X-rays, as carbolic acid was applied after epilation.

Furunculosis

Treatment with X-rays.—Radiotherapy may be suitably used for the treatment of isolated furuncles of long standing. As in the treatment of coccogenic sycosis, the suppuration is sometimes increased at first, and relapses have taken place in some of the cases we have treated, but the condition will yield to repeated courses of the rays. In one of our patients who had suffered from constantly recurring boils on the back of the neck for 15 years, relief ensued after 30 applications. No relapse occurred for 15 months, when another crop of boils appeared on the nape of the neck. Another series of 11 exposures was given in October, 1906, with the result that some of the hair was removed and the lesions disappeared. The opsonic treatment of staphylococcic

infections is still on trial, but in cases of long-standing furunculosis on limited areas of the body, as in similar cases of sycosis, the X-rays are more simple of administration and give satisfactory results.

Hypertrophic Scars

Treatment with light.—The smoothness and suppleness of the scars resulting from Finsen light treatment, and the improvement that occurred in old scars produced by surgical procedures after the adoption of this method, led us to employ it in cases of simple hypertrophic scars. In all cases treated by us there was improvement, and in some it was much greater than could have been anticipated.

A case which strikingly illustrates the effect of light on extensive scars was that of a lady *æt.* 28. Seven weeks before she came for treatment she had been severely burned about the face and feet by sulphuric acid upset from a cart in Lisbon. She was laid up for a fortnight after the accident. The burns left several scars, which became hypertrophic. There were two tense thick bands running across both inner canthi, a raised linear scar in the site of the right naso-labial fold, one or two small, less thickened patches on the right side of the upper lip, and two in the left temporo-frontal region. The thickening was increasing, and the disfigurement was becoming worse. The light treatment was commenced on February 21st, 1905, applications being made for one hour daily. The treatment was continued until July 31st. The patient had 41 applications altogether. The scars and hypertrophic processes were gradually softened and flattened, and when she returned, after a

time, for inspection the thickened processes had almost disappeared from the inner canthi, and the other scars were so much reduced that practically all the disfigurement was removed.

The method is not less successful in removing scars left by tuberculous abscesses. One patient, *æt.* 29, had an unsightly scar on the left side of her neck, extending from the middle line to the anterior border of the sterno-mastoid. The scar, which had an irregular surface, with several loose hanging pieces of scar tissue, was the result of tuberculous abscesses. After 20 applications, three times a week, from June 21st to July 24th, 1905, the cicatricial tissue was softer, the surface of the scar flatter and smoother, and the projecting processes of fibrous tissue had become detached. The result was a great improvement in the appearance and texture of the cicatrix.

Another patient, *æt.* 28, presented several scars resulting from operations upon tuberculous glands on the right side of the neck and chin. In addition to the flat or depressed scars there was a prominent band of hypertrophic cicatricial tissue on the site of a line of incision at the anterior border of the right sterno-mastoid. The disfigurement was great. She was treated November 7th-15th, 1904, March 14th-20th, 1905, and May 11th-19th, 1905. In all, 34 applications were made. The elevated parts were reduced in size and thickness, and became flush with the surface, while a deeply depressed scar was, to a certain extent, levelled up. All the scars became whiter and less conspicuous.

Indolent Ulcers and Wounds

Treatment with X-rays.—Sjögren and Sederholm found the rays satisfactory in the treatment of chronic ulcers. Gautier treated a case of varicose ulcer successfully. Lyster finds that varicose ulcers do well, but break down again as soon as the patient gets about. It is probable that the stimulating effect of the X-rays would be found useful in all chronic ulcerations.

Leprosy

Treatment with X-rays.—There is evidence to show that the local manifestations of leprosy are amenable to radiotherapy. Sequeira treated a tubercular case in 1901 with much benefit, and other cases are on record in which retrogression or disappearance of the nodules has resulted. We have treated a mild case of anæsthetic leprosy in a man aged 50, in whom there were infiltrated patches on the legs and feet, lumbar region, and a probably independent elephantiasis in a slight degree of one leg. Under the treatment the infiltration disappeared, the nodules became almost imperceptible, the anæsthesia markedly lessened, and the elephantiasis much improved. Scholtz treated two cases without success. From histological examination of a piece of excised skin he concluded that healing was due to the reactive inflammation, and not to any bactericidal effect. Oudin and Allen obtained some improvement, while others report negative results.

Pruriginous Dermatoses

Treatment with X-rays.—A large majority of authors agree that localised pruritus is very favourably

influenced by the rays, but that generalised pruritus is difficult to treat. A case of prurigo was treated without benefit by Scholtz. Belot, on the other hand, reports a successful case. Lichen planus in some instances has yielded to this method, and in a case treated by us a small localised patch of hypertrophic lichen planus in the sacral region completely disappeared after 14 applications of 12 to 15 minutes, and a patch of lymphangioma circumscriptum cutis in the right lumbar region of the same patient yielded to 15 exposures. In another patient a large patch of thickened lichen planus was removed in 6 applications.

Psoriasis

Treatment with X-rays.—Of 16 cases of psoriasis observed by Allen, there was benefit in all, and at times complete removal of the lesions. In one case, in which the treatment was confined to a single hand, the hand treated was cured, while the other under medical treatment failed to improve. Scholtz suggests prophylactic raying in patients showing marked tendency to relapse. Most of his cases were greatly improved, and some completely cured, but relapses reduced the value of the treatment. Like Allen, he thinks that the usual applications should be combined with X-rays and continued for some time after completion of the cure. Hyde, Montgomery, and Ormsby treated 32 cases, with results which were satisfactory, at least temporarily. Successful results have also been obtained by Albers-Schönberg, Hahn, Sjögren and Sederholm, Ehrmann, Ullmann—who considers that psoriasis is the dermatosis

of all others to be most readily affected by X-rays—Kienböck, Holzknecht, Belot, Williams, Pusey, Bowen, Grunmach, V. Ziemssen, Grouven, Rubinstein, Payne, Wills, and others.

There seems, indeed, to be a consensus of opinion that X-rays can cause rapid removal of the lesions of psoriasis, and they certainly have the advantage of cleanliness and probably of rapidity of action over ointments, but apparently they are equally useless in the prevention of relapse. They are most useful in small localised patches which are refractory to other methods. In a few cases of psoriasis treated by us the results have been satisfactory. In a female patient patches on the left knee and left side of the nose disappeared after five applications of 10 minutes to each, and had not recurred a year afterwards. In a male patient two patches on the leg disappeared after three applications of 10 minutes. The patches gradually become pale in colour and pigmented, and the scales become detached. In another patient, a physicist, who suffered from severe psoriasis affecting the back of the hands and nails, three exposures were given on December 19th, 20th, and 21st, 1906. On the first two occasions the duration of the exposure was $7\frac{1}{2}$ minutes to each hand, on the third day 10 minutes, at a distance of 8 in. from the anode; the current in the primary was $2\frac{1}{4}$ ampères. He was not seen again until January 25th, 1907. The psoriasis had then almost completely disappeared, the fissures had healed, and all that remained was a faint staining of the skin corresponding to the situation of the old patches, with one or two small patches on the terminal phalanges near the nails. The nails also were greatly improved.

Seborrhœides

Treatment with X-rays.—Belot employed radiotherapy with benefit in two cases, one of seborrhœic eczema of the leg, and an unusual form of seborrhœides of the face in which other treatment had failed.

Sinuses and Fistulæ

Treatment with X-rays.—Berry Hart had two successful cases of old sinuses of the abdominal wall which healed when all other methods had failed. Spring and Hart had good results in callous sinuses, and J. B. Murphy in intestinal fistulæ.

Sycosis

Treatment with X-rays.—Schiff and Freund were the first to treat sycosis by radiotherapy. In five cases out of 17 treated in 1901 a single series of exposures effected a cure, in five a second series was needed, in one case a fourth series was required.

Schiff reported that after the shedding of the hair no new pustules appeared, and secretion and scab formation ceased; but even before the shedding of the hair there was a noticeable diminution of the inflammatory processes, and the more striking inflammatory infiltration in the surrounding tissue disappeared. After seven to eleven sittings the hair became loose and fell out spontaneously or with slight traction. The redness and all other signs of the disease disappeared in the course of the next 10 or 12 days. The affection returned in certain cases after from two to four months, but in a number of cases the hair grew again as before without any relapse.

In Allen's experience of 23 cases, almost all of long standing, the results were for the most part prompt and excellent, and in a few almost astonishing. In several cases treated at the Broca Hospital the results were, on the whole, favourable, and certainly more rapid than those obtained by ordinary methods (Belot).

Albers-Schönberg, Scholtz, Spiegler and Gastou also speak favourably of radiotherapy in this disease. Pusey, Williams, Grouven, Gassmann, Schenkel, and Ullmann have had good results. Kienböck and Holzknecht report favourably of the method. Lancashire also speaks well of it.

There can be no doubt that sycosis, either of hypomycetic or of coccogenic origin, is, as a rule, amenable to the X-ray treatment. The pustulation rapidly dries up under the rays, in spite of the fact that they are not anti-parasitic; when ringworm fungus is present a sufficient dose must be given to produce epilation, and this may be accomplished by single exposures, as in the treatment of tinea tonsurans, but great care must be taken, as the beard region is more sensitive to the rays than the scalp. We have successfully treated several cases in this way. In ordinary sycosis great improvement is brought about by short exposures of X-rays, but more radical results are obtained after depilation. Permanent results, however, are not always obtained. The results are better in tinea than in coccogenic cases, which are more apt to relapse owing to the difficulty of getting rid of the cocci in the skin. In ringworm the fungus is removed with the hair, as in the treatment of tinea tonsurans.

In a case of ours, the patient, aged about 50, had suffered with chronic coccogenic sycosis for 10 years. All treatment, including painting with pure carbolic acid, had failed to give him relief. When first seen he had a bald cicatricial area occupying the lower part of the right side of the face and chin. On and at the periphery of this area were numerous follicular papules and pustules, with inflammation of the skin between the hairs. The first application of X-rays was followed by drying-up of the pustules and diminution of the irritation, and after seven exposures the soreness and burning of the part disappeared, the follicular inflammation subsided, and the affected surface was to all appearances completely restored to the normal. A month later there were no pustules, and the greater part of the surface was pale and free from infection, a few inflammatory papules at the lower border of the bald patch being all that remained of the disease. The patient said he had experienced immense relief and had been able to forget the existence of the complaint entirely. After five more exposures all visible traces of the infection had disappeared, but the condition repeatedly relapsed at intervals of two or three months, chiefly at the borders of the parts exposed, and even the production, on several occasions, of a somewhat severe erythema, followed by falling of the affected and healthy hairs, failed to prevent recurrence. On each occasion, however, a short series of exposures caused complete disappearance of the lesions for a considerable time. The last interval between the exposures was eight months, and the patient, in June, 1907, had not been seen for six months.

Xanthoma

Treatment with X-rays.—At a meeting of the Dermatological Society of London (November 12th, 1902) Willmott Evans showed a case of xanthoma of the elbows which he had successfully treated with X-rays.

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